THE TRIANGLE ARITHMETICS

ACCURACY SIMPLICITY UTILITY

BOOK TWO

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BY

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INTRODUCTION

TO THE BOYS AND GIRLS WHO WILL USE THIS BOOK

This arithmetic book has been written for you. It presents the activities of your life and of the life of those about you, which cannot be understood without the use of arithmetic. Arithmetic is used in almost everything you do both in and out of school. Whenever you purchase groceries, you use arithmetic. Whenever you measure your weight, your height, or the foods that you eat, you use arithmetic. Whenever you use the calendar, the clock, the thermometer, or read the speedometer on your father's automobile, you use arithmetic. In geography when you tell the size of cities, the value of the products of a country, the heights of mountains, or the depths of the oceans, you use arithmetic. When you count time in music, you use arithmetic. The farmer, the grocer, the banker, in fact everyone, uses arithmetic.

First of all you must be able to perform the simple operations of arithmetic quickly and accurately. A great deal of practice and drill are necessary to give you skill in addition, subtraction, multiplication, and division. You will find throughout this book many exercises to provide this practice. You will need to know what errors you make and why you make them. Tests are given which help you to locate your difficulties. Practice tests provide drill to be used to overcome these difficulties. Be sure to practice every exercise until you have mastered it.

The authors believe that boys and girls should solve real problems—problems which arise in your home life, in your school work, in your play and games, problems which your father and mother must meet and solve, and problems about trade, business, and government. The problems in this book are about things in which boys and girls are interested. In many of the groups of problems there are topics which you will wish to discuss with your parents and friends, or concerning which you will need to consult encyclopedias, reference books, and magazines for information.

TO THE TEACHER

These textbooks embody the results of the scientific investigations of curriculum making, of the learning process, and of the psychological analysis of the steps in the various processes in computation. The contents follow closely the outlines of the best known courses of study. Special consideration has been given to the various reports contained in the Yearbooks of the Department of Superintendence, Yearbooks of the National Council of Teachers of Mathematics, Yearbooks of the Elementary School Principals, as well as to the results of the experimental work conducted by the authors to determine the causes of pupils' errors in computation and in problem solving. The whole development of the processes has been checked by careful classroom trial. The standards are based on the results of tests given to thousands of children.

Book II is for grades 5 and 6. The work of the fifth grade begins with a careful review of the work of grade 4. Diagnostic tests and remedial exercises make it possible to adjust the review to the needs of the individual pupils. Pupils are made conscious of their difficulties by purposeful and well motivated practice material. The standards aid the pupil to measure his progress. A similar review is given at the beginning of grade 6. At the end of each grade there is a careful check up of the work that has been developed by standardized diagnostic tests by means of which the teacher can discover possible deficiencies in the work.

THE DEVELOPMENT OF THE PROCESSES

a. Special stress is placed on the careful grading of the steps in each of the processes of fractions and decimals so that the pupils encounter only one new difficulty at a time.

b. Specific drill exercises are provided on the points which have been found by investigations to present special difficulty to pupils. (See pages 71, 72, 74, 77.)

c. Stress is placed on the use of illustrative examples to which the pupils may refer when in difficulty. These examples have made it possible to show pupils how to work examples differing slightly from the pattern presented in detail in the development. (See pages 73, 74.)

d. Ample drill materials to fix each step in the development are provided, special stress being given to the elimination of the causes of error.

e. After a step has been developed, special provision has been made to insure the retention of the skill by scientifically distributed drill in subsequent exercises. Carefully standardized practice tests at the ends of chapters make it possible both to measure the achievements of the pupils from time to time and to review the work that has been done. The problem material especially provides for the continuous use of the processes that have been learned.

f. Provision is made for specific diagnostic exercises at the end of each development by means of which the pupils and teachers can make a careful check on the work that has been done. These diagnostic tests are made up of examples each of which represents a distinct type differing in some respect from the other examples in the test. The teacher is thereby enabled to determine the exact type of example which is difficult for the individuals in the class.

g. Objective tests for reviewing principles will be found from time to time at the end of the explanation of important development work.

h. In the development of each step the pupil is given specific directions as to procedure and a minimum of rationalization is undertaken.

i. From the beginning the pupils are taught to check their work.

THE PROBLEM MATERIAL

a. Each new step in a process is presented in some situation in which it is needed and as it functions in life.

b. The development of the processes is paralleled closely by the problem work, which applies the processes in life situations and insures a check on the power of the child to apply the process being developed.

c. The problem content stresses the social values of arithmetic and their applications to the life of the child in and out of school. Geography, reading, history, measurement, buying and selling, and the common business practices of everyday life are the sources of the problem material. Modern business practices are developed. Wherever possible data based on real life situations have been used in the problem units. Exact data contained in government reports, reports of farm clubs, scientific investigations, and other sources of information form the basis for the problem materials.

d. The pupil is frequently given cues to direct him in the solution of problems. The solution of problems is facilitated since they are real to the child and are within his experience.

e. Definite practice exercises on problem solving are found in the materials for both grades 5 and 6 as well as in the other grades.

f. At the end of each chapter are problem scales which have been carefully standardized. These scales make it possible to measure the progress during the year of the pupil in the ability to solve problems.

g. At the end of many of the problem units there are suggested activities and starred problems which suggest ways of applying what has been learned to situations both in and out of school. These problems suggest desirable forms of pupil activity and make it possible for the teacher to give a special type of work to the pupils who do not need all of the practice given in the problem or practice materials. The ability of the pupils to apply what has been learned to a real situation is the proof needed that the arithmetic he is learning actually functions.

h. The problems are stated clearly and simply in the vocabulary of the children of these grades.

THE SCIENTIFIC DISTRIBUTION OF NUMBER FACTS AND PROCESSES

a. In the development of the drill exercises on the fundamentals, special attention has been given to the scientific distribution of the number facts according to their learning difficulty.

b. Special stress has been placed on the necessity of giving the pupils contact with the varied types of examples in each of the processes. This has been found to be necessary since examples differ greatly among themselves in the specific methods by which they are solved, and the pupils should be given an opportunity to solve them in their drill work under the immediate supervision of the teacher.

c. The great care with which the steps in the development of the processes in fractions and decimals have been analyzed will be evident from a survey of the pages in which these processes are developed.

d. Standardized tests in all processes are found throughout the books. The standard that have been set up is reasonable speed and 100 per cent accuracy.

PROVISION FOR INDIVIDUAL DIFFERENCES

a. The specially constructed diagnostic tests make it possible for the teacher to determine the nature of the difficulties of the individual pupils.

b. Pupils are directed to do special work on the particular types of examples which they find difficult in the diagnostic tests and practice exercises.

c. The practice exercises in each of the processes make it possible for the teacher to determine the particular process in which the pupil is weak, and the element in each process which may be causing difficulty. These practice tests in fractions and decimals begin with simple elements and proceed to others that are increasingly difficult. Each test is therefore a scale by means of which the teacher can determine the level of the achievement of the individual pupils on repeated standardized measurements.

d. The problem scales make it possible for the teacher to select the pupils who are weak in problem solving. The special practice exercises in problem solving are especially helpful in work with these pupils.

e. At the end of many of the problem units there are starred problems. These are either more difficult problems than the others in the group, or are suggested activities which the teacher may assign to the superior pupils who have completed the minimum work expected of the class.

CONTENTS

FIFTH GRADE

SIXTH GRADE

CHAPTER I

USES OF ARITHMETIC

1. The Hayes School and the Johnson School had a field meet. John threw the basket ball 44 feet and Peter threw it 46 feet 4 inches.

a. How much farther than John did Peter throw the ball?

b. Show how arithmetic is used in games that you play.

2. Tom bought 4 pounds of butter at 45¢ a pound. He gave the clerk a five-dollar bill in payment.

a. What change should Tom receive?

b. Make a list of ways in which a grocer uses arithmetic. One fifth-grade girl listed thirty-one ways.

3. Name and give the value of all the United States coins that you know. If you had one of each, how much money would you have? Why do we need so many different coins?

4. Mary is cooking oatmeal. She put the oatmeal into boiling water at 12 minutes to seven. If the oatmeal must boil 20 minutes, at what time will it be cooked?

5. Make a list of at least six ways in which arithmetic is used in your home.

6. How does the man at the gasoline station use arithmetic?

7. Show how you use arithmetic in drawing, geography, history, and music.

The *Santa Maria*, flagship of Columbus, beside the *Leviathan*.

USING ARITHMETIC IN HISTORY

On his first voyage to America Columbus set sail from Spain August 3, 1492. He was delayed for some time at the Canary Islands, but finally sailed from these islands on September 6, 1492. He landed the following October 12 on one of the islands which we now call the West Indies.

1. How long did it take Columbus to sail from the Canary Islands to the West Indies? How many days does it take one of our large ocean liners to cross the Atlantic Ocean? How much faster than the voyage of Columbus is this?

2. The distance from the Canary Islands to the West Indies is about 3,500 miles. How many miles did Columbus sail a day on the average?

3. The *Leviathan*, one of our largest ocean liners, travels about 25 miles an hour. In how many hours can it travel 3,500 miles? How many hours more than 5 days is this?

4. The largest vessel in the fleet of Columbus was the *Santa Maria*. This ship was 128 feet long, 25 feet wide, and

15 feet deep. The *Leviathan* is 907 feet long, 100 feet wide, and 58 feet deep. How much longer than the *Santa Maria* is the *Leviathan?* how much wider? how much deeper?

5. A city block is about 600 feet long. How much longer than such a block is the *Leviathan?* Measure off a distance on some street as long as the length of the *Leviathan*. Beginning at the same point, measure off the length of the *Santa Maria*. This will give you an idea of the size of the ships in which Columbus made his voyage.

6. Columbus kept a journal of the distance his ships sailed each day. This is his record for the first week in October. He measured the distance in leagues. Four miles make one Italian league.

October 1	25 leagues	October 4	63 leagues
October 2	41 leagues	October 5	57 leagues
October 3	47 leagues	October 6	40 leagues
October 7	29 leagues		

How many leagues did the fleet sail in the seven days? How many miles was this?

7. In how many hours can the *Leviathan* travel as far as the fleet of Columbus sailed in these seven days?

8. Account for the fact that the fleet of Columbus did not sail as far on some days as on others. Do our modern steamships usually do this? Why?

9. On the three vessels in the fleet of Columbus there were 90 seamen and 30 officers. How many a ship did this average?

10. On a trip across the Atlantic during the World War, the *Leviathan* carried 3,500 soldiers. How many more than the average number of persons on each ship in Columbus's fleet was this?

NAMES OF PARTS OF EXAMPLES

Each part of an example in arithmetic is named. You should learn these names, for they are often used.

Addition	**Subtraction**
$\left.\begin{array}{r}45\\36\\84\end{array}\right\}$ *addends* $\overline{165}$ *sum*	496 *minuend* 354 *subtrahend* $\overline{142}$ *remainder or difference*
Multiplication	**Division**
435 *multiplicand* 27 *multiplier* $\left.\begin{array}{r}3\,045\\8\,70\;\;\end{array}\right\}$ *partial products* $\overline{11\,745}$ *product*	21 *quotient* *divisor* 27)569 *dividend* 54 $\overline{29}$ 27 $\overline{2}$ *remainder*

1. The answer in an addition example is called the ____.
2. The answer in a subtraction example is called the ____.
3. The answer in a multiplication example is called the ____.
4. The answer in a division example is called the ____.

State the meaning of each of the following words:

5. minuend	8. sum	11. product
6. subtrahend	9. multiplier	12. dividend
7. divisor	10. quotient	13. remainder

Name the parts of each of the following examples:

$$\begin{array}{r}763\\592\\763\\495\\\hline 2{,}613\end{array}\qquad\begin{array}{r}9{,}642\\-3{,}592\\\hline 6{,}050\end{array}\qquad\begin{array}{r}324\\\times 21\\\hline 324\\6\,48\;\;\\\hline 6{,}804\end{array}\qquad\begin{array}{r}3\\25\overline{)87}\\75\\\hline 12\end{array}$$

CHECKING YOUR WORK

The best way to see if your work is correct is to check it. Study the following examples carefully.

To Check Addition

86	86
59	59
43	43
57	57
96	96
341	341

After you have added the numbers by beginning at the top and have written the sum, add by beginning at the bottom. If the sums are the same, the work is probably correct.

To Check Subtraction

3,954	**Minuend*
2,386	*Subtrahend*
1,568	*Difference*
3,954	**Check sum*

After you have found the difference, add the subtrahend and the difference. If the sum is the same as the minuend, the work is probably correct.

To Check Multiplication

45	21
$\times$21	$\times$45
45	105
90	84
945*	945*

Interchange the multiplier and multiplicand, and multiply. If the products are the same, the work is probably correct.

To Check Division

$$5\overline{)874^*}$$ 174 and 4 rem.

The check.

174
$\times$5
870
4
874*

Multiply the quotient by the divisor and add to the product the exact remainder, if there is one. If the answer to this work is the same as the dividend, the work is probably correct.

PRACTICE IN CHECKING

Find the answers to the following examples and check your work.

Set I

1. 976
453
486
594
736

2. Subtract
17,046
9,087

3. 69
×86

4. 78
×57

5. Subtract
11,604
8,711

6. 8)7,364

7. 9)1,765

Set II

8. 757
499
504
72
787

9. Subtract
5,963
2,486

10. 78
×48

11. 96
×79

12. Subtract
8,004
2,236

13. 7)14,021

14. 6)4,278

Set III

15. $2.49
7.87
4.56
8.65
7.98
8.39

16. Subtract
$48.17
29.48

17. $5.20
×60

18. $3.40
×205

19. Subtract
$110.00
97.48

20. 75)5,675

21. 87)16,957

Set IV

22. Add $4.56, $6.45, $5.84, $6.36, $8.89, and $9.79.

23. Subtract $64.90 from $965.81.

24. Multiply $8.25 by 74.

25. Divide $172.50 by 25.

CHECKING THE GROCER'S BILL

1. Mary's mother gave her the grocer's bill to check. The bill is shown below. Check it.

WM. LEWIS
GROCERY
CLEVELAND, OHIO

19—

Sold to Mrs. Albus

	Balance forward		
4	lb. Butter 62c.	2	48
3	Bread 9c.		27
6	lb. Carrots 9c.		54
20	lb. Sugar 7c.	1	40
1	lb. Coffee		57
		5	26

Here are the prices which were charged at another grocery store.

Potatoes, pk.	50¢
Butter, lb.	46¢
Milk, qt.	12¢
Cookies, lb.	39¢
Salt, box	8¢
Coffee, lb.	58¢
Lard, lb.	21¢
Bread, loaf	9¢
Peaches, can	38¢
Corn, can	17¢

2. Find the total of each of the orders below. Use these prices.

a. 2 lb. of coffee, 2 lb. of butter, 1 box of salt.

b. 2 pk. of potatoes, 1 lb. of butter, 2 loaves of bread.

c. 6 qt. of milk, 5 lb. of lard, 2 cans of corn.

d. 1 lb. of coffee, $\frac{1}{2}$ lb. of butter, 1 box of salt.

e. 3 lb. of lard, 4 lb. of cookies, $\frac{1}{2}$ pk. of potatoes, 1 can of peaches.

3. Make up two orders of at least three items each and find the total bill.

***4.** Find the costs of the above items at your grocer's and figure one or the bills at local prices.

***5.** Check some bill that your mother receives at home.

PRACTICE IN ADDITION

You should be able to give all the sums in 3 minutes.

	a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*
1.	3	4	7	8	5	3	7	8	5	6
	1	5	3	6	2	4	6	2	1	8
	2	3	2	3	2	5	4	4	9	5
2.	1	8	2	9	3	6	4	5	6	1
	5	1	7	2	7	4	9	2	8	4
	2	3	1	9	8	6	4	5	7	7
3.	4	3	9	1	7	5	6	4	9	6
	8	1	1	7	9	4	6	5	7	8
	1	5	8	4	7	2	6	9	3	9
4.	5	8	3	9	6	1	2	3	4	4
	2	2	7	8	7	7	6	5	9	1
	6	1	7	5	2	9	7	5	8	9
5.	9	4	8	1	7	4	3	2	6	8
	5	2	3	6	8	9	9	8	3	4
	1	7	7	8	8	5	2	2	8	9

Special practice with the more difficult additions. Keep a record of the number of examples you work, and the number you have correct on three trials of this exercise.

	a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*
6.	4	6	7	3	5	7	9	5	5	3	4
	9	4	3	6	9	2	4	6	3	8	5
7.	9	4	7	5	9	8	8	7	8	6	8
	5	7	9	7	8	6	9	8	5	9	7
8.	5	6	6	9	6	4	7	3	8	7	7
	8	7	8	6	5	8	4	5	3	5	6

A CASH ACCOUNT

Tom's father decided to give him an allowance of $2 a week, out of which he was to pay all his expenses except board and room. This money was to be in addition to any that Tom himself might earn. In order that he might keep a record of the money that he spent and the money that he received, his father bought him a small account book. This is the record that Tom kept for one month:

19—		Cash Received			19—		Cash Paid Out		
Oct.	1	Allowance	2	—	Oct.	4	Cap	1	50
	8	Allowance	2	—			Stockings		50
	10	Cut Jones' Lawn		75		8	Bicycle Repairs		75
	15	Allowance	2	—		15	Football Game		25
	22	Allowance	2	—		20	Movie		10
	29	Allowance	2	—		21	Candy		05
						24	Screws		05
						25	Book	1	05
						31	Balance		?
									?
				?					

1. How much cash did Tom receive in October?

2. How much did he spend?

3. How much did he have left at the end of the month?

4. How much did he earn in addition to his weekly allowance?

5. How much did he spend for clothing? for amusements? for other things?

*6. Keep a record for one month of the money which you receive from allowances, gifts, and earnings, and the money which you spend. Show how you spent the money and the amount of money that you have left.

TEST IN ADDITION

You should be able to find the sums of five of these examples in three minutes. Write your answers on a folded paper placed below the examples. Check your work.

	a	*b*	*c*	*d*	*e*	*f*
1.	68	75	67	82	16	44
	87	23	24	23	87	96
	53	42	63	42	54	75
	15	98	99	68	97	89
	39	39	66	96	48	59
2.	27	41	79	56	10	93
	90	78	27	14	89	16
	89	69	55	95	28	15
	66	73	73	78	65	34
	68	18	17	87	74	87
3.	68	87	28	79	53	42
	40	35	40	13	30	46
	99	71	57	86	75	68
	60	92	45	52	33	52
	69	49	79	50	19	27

TEST IN SUBTRACTION

You should be able to find the answers to these examples in four minutes. Write your answers on folded paper.

	a	*b*	*c*	*d*	*e*
1.	3,756	4,109	8,386	7,114	9,223
	2,879	3,659	3,787	2,235	3,767
2.	8,964	7,005	7,010	8,005	5,500
	2,999	3,878	4,359	6,215	3,444
3.	9,364	9,082	8,003	9,338	12,421
	6,368	5,199	4,609	7,884	5,689

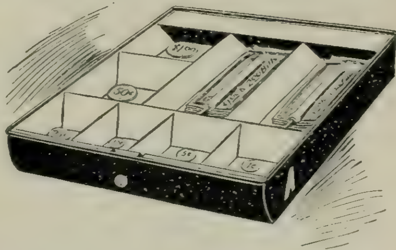
MAKING CHANGE

One Saturday Harry worked in his uncle's grocery store. Below are some of the things he had to know in order to make change correctly. How many of them do you know?

1. Five cents and what coin equal 10¢? 15¢? 6¢? 55¢? 30¢? $1.05?

2. A dime and what coin equal 15¢? 20¢? 11¢? 35¢? $1.10? 60¢?

3. A quarter and what coin equal 26¢? 30¢? 75¢? $1.25? 35¢? 50¢?



A cash drawer with a place for each kind of money.

4. A half dollar and what coin equal 55¢? 75¢? 51¢? 60¢? $1? $150?

5. What two coins equal 6¢? 30¢? 35¢? 75¢? 15¢?

6. What three coins equal 36¢? 16¢? 65¢? 80¢? 31¢?

7. What three coins may be given in payment for an 8¢ loaf of bread and a pound of butter costing 48¢?

8. Harry bought 2 apples at 5¢ each and gave the clerk a quarter. The clerk gave him a dime and a nickel in change. Was the change correct?

9. In counting change on a 28-cent order paid for with a $5 bill, a clerk counted like this, "29, 30, 40, 50, $1, $2, $3, $4, $5." What coin or bill did he count at each number?

Count change for each of the following purchases.

	Article	Cost	Payment		Article	Cost	Payment
10.	Sugar	26¢	$1.00	**14.**	Eggs	60¢	$5.00
11.	Bread	11¢	50¢	**15.**	Salt	8¢	$1.00
12.	Butter	54¢	$1.00	**16.**	Tea	68¢	$2.00
13.	Flour	89¢	$2.00	**17.**	Coffee	38¢	$1.00

A READING EXERCISE

I. The fifth- and sixth-grade children were to have a sleigh-ride party. There were 46 fifth-grade pupils and 58 sixth-grade pupils. How many pupils were there in the party if they all went?

1. Which of the following facts are you asked **to find?**
   a. The number of pupils in the fifth grade.
   b. The number of pupils in the party if they all went.
   c. The number of pupils who did not go.
   d. The number of pupils who could ride in one sleigh.
2. Which of the following facts is **given** in the problem?
   a. The number of pupils who could not pay.
   b. The number of sleighs which would be needed.
   c. The number of pupils who could not go.
   d. The number of pupils in the two grades.
3. In which of the following ways would you **work** this problem?
   a. Add 58 and 46. *c.* Multiply 58 by 46.
   b. Subtract 46 from 58. *d.* Divide 58 by 46.
4. Which of the following answers is nearest to the **correct answer?**
   a. 94 pupils. *b.* 82 pupils. *c.* 106 pupils. *d.* 12 pupils.

II. Only 94 pupils can go on this sleigh ride. If each pupil is given three sandwiches, how many must be ordered for the party?

1. Which of the following facts are you asked to **find?**
   a. The cost of the sandwiches.
   b. The number of sandwiches for each pupil.
   c. The total number of sandwiches to be ordered.
   d. The number of pupils who want sandwiches.

2. Which of the following facts is **given** in the problem?
   a. The cost of the sandwiches a pupil.
   b. The number of sandwiches for the fifth grade.
   c. The number of sandwiches for each pupil and the number of pupils who can go.
   d. The number of sandwiches not eaten.

3. In which of the following ways would you **work** this problem?
   a. Multiply 94 by 3.
   b. Divide 94 by 3.
   c. Subtract 3 from 94.
   d. Add 3 to 94.

4. Which of the following is the **correct answer?**
   a. 282 sandwiches.
   b. 91 sandwiches.
   c. 272 sandwiches.
   d. 97 sandwiches.

LEARNING TO SOLVE PROBLEMS

Read each problem carefully. Be sure that you understand all the words. Ask yourself questions *a*, *b*, and *c* about each problem. Then solve it and check your work.

a. What am I asked to find in the problem?

b. What things are told in the problem that will help me to find the answer?

c. What must I do to solve the problem?

1. Jack wants a pair of skates. The price of the skates is $4.80. Jack can save $.80 a week. In how many weeks will he save enough money to buy the skates?

2. Fred took a trip with his father. When they started, the speedometer on the car read 8,569 miles. When they returned home, it read 10,433 miles. How many miles did they travel on their trip?

3. Jennie spent $8.25 for cloth for a dress. She bought 3 yards. What did the cloth cost a yard?

4. A railroad car when empty weighs 33,254 pounds. When filled with coal, it weighs 86,564 pounds. How much does the coal weigh?

5. A baseball team bought a bat for $1.60 and a ball for $1.50. What did the bat and ball cost together?

6. Jennie paid $2.00 for a bag of sugar. If the price of the sugar was 8¢ a pound, how many pounds did she buy?

7. Out of a list of 50 words in a test, Mary spelled 9 incorrectly. How many words did she spell correctly?

8. John raises chickens. One week he bought 3 bushels of mixed feed at $1.65 a bushel. What did he pay for the feed?

9. Three sacks of oats together weighed 224 pounds. A bushel of oats weighs 32 pounds. How many bushels were there in the three sacks?

10. What did May pay for 6 dozen oranges which she bought at 45¢ a dozen?

11. Julia has $4.25. How much more than this must she have before she can buy a $5 toilet set?

12. John has been collecting stamps. He has 198 stamps. They cover 18 pages in his stamp book. How many stamps, on the average, are on each page?

13. On a reading test Margaret read 567 words in three minutes. How many words did she read, on the average, in one minute?

14. One Saturday Harry delivered 18 orders for Mr. Smith, the grocer. He was paid 5 cents for each order he delivered. How much did Harry receive in all?

15. One Christmas Janet bought a penknife for $1.50 for her father, a book for $1.75 for her mother, and a toy sailboat for $.75 for her brother. What did she spend in all?

FINDING DIFFICULTIES IN ADDITION

This exercise contains many different kinds of addition examples. Practice until you can work all of them.

Set I

	a	*b*	*c*	*d*	*e*
1.	18	4	5	9	18
	7	6	1	6	51
		18	5	2	
				1	
2.	753	5,241	13	342	30
	236	4,537	21	104	20
			42	452	20
3.	204	81	7,104	46	304
	301	26	2,060	3	72
	203	32		30	3
4.	58	627	3,965	5,248	4,953
	24	258	3,714	2,396	7,638

Set II

5.	8,564	68	337	162	957
	1,987	47	406	360	777
		53	238	407	995
6.	3.926	807	926	298	399
	2,518	508	565	46	7
	6,029	808	409	785	607
7.	$.01	$.60	$.25	$1.65	$4.89
	.04	.40	.54	2.64	.26
	.03	.20	.72	7.28	.05
				6.53	8.08

HOW TO READ AND WRITE LARGE NUMBERS

In newspapers, books, and magazines, numbers are often used that are very large. In order that you may be able to read such large numbers easily and accurately, study the following work.

The population of the United States according to the last census was 117,859,495.

The number is read one hundred seventeen million, eight hundred fifty-nine thousand, four hundred ninety-five.

Large numbers are divided by commas into periods of three figures each, beginning at the right. This table will help you to remember the name of each period.

Millions	Thousands	Units
117	859	495

In reading a whole number, each period, except the units, is named.

$525,000,000 is read five hundred twenty-five million dollars, since there are no numbers in the thousands or units periods.

Copy these numbers, divide them into periods, and be ready to read them:

1. 785926	**3.** 125789	**5.** 859642
2. 48653	**4.** 11206804	**6.** 458763284

Read these sentences:

7. The distance around the earth is about 25,000 miles.

8. The area of Alaska is 590,884 square miles.

9. The population of New York City, according to the 1920 census, was 5,620,048.

10. Freight vessels often carry from 12,000 to 18,000 bales of cotton.

11. The distance from Portland, Maine, to Yokohama, Japan, is 12,796 miles. The distance from Portland, Maine, to San Francisco is 3,413 miles.

12. In 1920 the United States imported 29,022,577 pounds of dried and frozen eggs.

13. In 1926 the United States exported 252,662,635 bushels of wheat.

Sometimes numbers larger than millions must be read.

14. The United States imported 1,297,439,310 pounds of coffee in 1920. When there are four periods, the fourth period from the right is billions. Read the number:

Billions	Millions	Thousands	Units
1	297	439	310

15. Read these numbers.

2,000,000,000   34,000,400,000   4,175,642,825

16. $2,910,082,505 was spent for automobiles in 1925.

17. $803,659,000 was spent for automobile tires.

18. In 1926 there was spent on public schools in this country, $2,016,812,685.

USING LARGE NUMBERS IN GEOGRAPHY

Large numbers are often used in geography. In solving the following geography problems, be sure to copy and place the numbers correctly.

1. One of the deepest oil-producing wells in the United States is 7,591 feet deep. How much more than a mile is this?

2. One of the deepest gas-producing wells in Pennsylvania is 7,756 feet deep. How much deeper than the oil well in problem **1** is this?

3. Lake Superior, the largest of the Great Lakes, is only 1,180 feet deep. How much deeper than this is the oil well in problem **1**? How much deeper than Lake Superior is the gas well in problem **2**?

4. The deepest spot in the Pacific Ocean is near the coast of Japan. Here the depth of the ocean is about 37,000 feet. How much deeper than Lake Superior is the Pacific Ocean at this point?

5. The highest mountain in the world is Mt. Everest in Asia. Its height is 29,141 feet. How much less than the depth of the Pacific Ocean is the height of this mountain?

6. The highest mountain in North America is Mt. McKinley in Alaska. Its height is 20,300 feet. How much higher than Mt. McKinley is Mt. Everest?

7. Is Mt. Everest more than 5 miles in height? how much more or less?

8. Niagara Falls is 167 feet in height. Yosemite Falls is 1,170 feet in height. How much higher than Niagara Falls is Yosemite Falls?

9. The Mississippi River is 2,486 miles long. The Missouri River is 2,945 miles long. How much longer than the Mississippi is the Missouri?

10. In a recent year there were 27,000,000 telephones in the world. 17,000,000 of them were in the United States. How many telephones were there in the rest of the world?

11. In a recent year there were about 27,650,267 automobiles in the world. There were 22,137,344 in North America alone. How many automobiles were there in the rest of the world? How many less than in North America were there in the rest of the world?

USING ARITHMETIC IN MEASURING

It will often be necessary for you to look up some fact before you can find the answer to a problem. The tables at the back of this book will help you to find facts needed.

1. Jack is 58 inches tall. How much more than a yard is this? how much less than 5 feet?

2. How much less than half a pound is six ounces? Name three things that are sold by the pound.

3. How many quart bottles can you fill with 6 gallons of milk? how many pint bottles?

4. How many eggs are there in 28 dozen?

5. How much are two dimes and a nickel? Name three things that cost about a dime each.

6. How many minutes is it from 2:45 A. M. to 4:15 A. M.? How many minutes is it from the time your school begins in the morning until you leave for home at noon?

7. A schoolroom is 24 feet long and 33 feet wide. Express its length and width in yards.

8. Harry can run 220 yards in 28 seconds. How much less than a minute is this?

9. At 7 o'clock, one April morning, the thermometer registered 46 degrees. How much above the freezing point was this?

10. Alice picked 48 quarts of strawberries. How much more than a bushel was this?

What does each of the following abbreviations mean?

11. ft.	**15.** gal.	**19.** in.	**23.** qt.
12. lb.	**16.** yd.	**20.** pt.	**24.** oz.
13. bu.	**17.** min.	**21.** pk.	**25.** mi.
14. doz.	**18.** sec.	**22.** rd.	**26.** hr.

READING AND WRITING ROMAN NUMERALS

On an old monument Ethel saw these words and letters:

ERECTED
A. D. MDCLXIII

Ethel could not read the date. She asked her father. He said, "The date is written in *Roman* numerals. The monument was erected in 1663." The numerals which we usually write are called *Arabic* numerals. This exercise will help you to read Roman numerals.

Study the table at the right carefully. Then be ready to answer the questions below.

ROMAN	ARABIC
I	1
V	5
X	10
L	50
C	100
D	500
M	1000

a UNITS	*b* TENS	*c* TENS	*d* TENS
I = 1	X = 10	XIV = ?	? = 16
II = 2	XX = 20	XXVI = ?	? = 27
III = 3	XXX = 30	XXXI = ?	? = 34
IV = 4	XL = 40	XLIX = ?	? = 45
V = 5	L = 50	LVIII = ?	? = 58
VI = 6	LX = 60	LXII = ?	? = 69
VII = 7	LXX = 70	LXXV = ?	? = 73
VIII = 8	LXXX = 80	LXXXII = ?	? = 88
IX = 9	XC = 90	XCIII = ?	? = 91

e HUNDREDS	*f* HUNDREDS	*g* HUNDREDS	
C = 100	CXI = ?	? = 142	? = 315
CC = 200	CCXX = ?	? = 271	? = 410
CCC = 300	CCLI = ?	? = 325	? = 196
CD = 400	CDLX = ?	? = 462	? = 724
D = 500	DXV = ?	? = 529	? = 811
DC = 600	DCXXV = ?	? = 617	? = 943
DCC = 700	DCCXI = ?	? = 710	? = 586
DCCC = 800	DCCCIX = ?	? = 890	? = 210
CM = 900	CMLXX = ?	? = 950	? = 625

1. Cover the Arabic numbers in columns ***a, b,*** and ***e*** and read the Roman numerals.

2. Write the value of each of the Roman numerals in column ***c*** in the Arabic form.

3. Write the value of each of the Roman numerals in column ***f*** in the Arabic form.

4. Copy the Arabic numerals in columns ***d*** and ***g*** and write opposite each of the numbers its value in Roman numerals.

5. Can you tell just why the years are numbered 1927, 1928, and so on? The letters A.D. and B.C. help us understand why. B.C. means, "Before Christ." For example, the year 75 B.C. means 75 years before the birth of Christ. A.D. means after the birth of Christ. A.D. 1856 means 1856 years after the birth of Christ.

6. How long ago was the monument built that Ethel saw?

7. Write in Roman numerals the year in which you were born.

8. At $10 a **M** what will 4,000 post cards cost? Remember that **M** means thousand.

Read these numbers:

9.	XXI	XXXVII	LVIII	XLV
10.	CIII	CXI	CXXIV	CCXIV
11.	XCI	MCX	MCLX	MCCLXV

Write the following in Roman numerals:

12.	36	48	73	105	1,140	1,775
13.	29	57	96	225	1,264	1,506
14.	31	54	82	126	1,854	1,066

FINDING DIFFICULTIES IN SUBTRACTION

This exercise contains many different kinds of subtraction examples. Practice until you can work all of them correctly.

Set I

	a	*b*	*c*	*d*	*e*
1.	9 4	15 7	87 3	46 21	897 356
2.	9 9	25 5	258 101	90 30	805 202
3.	77 72	686 683	869 22	774 414	793 593

Set II

4.	73 8	494 49	868 539	729 456	921 656
5.	6,172 4,753	523 195	180 2	909 727	802 618
6.	4,001 2,883	9,200 3,373	574 108	4,981 3,008	8,043 7,606

Set III

7.	9,080 6,759	8,010 3,584	11,900 9,901	7,462 4,399	3,376 2,968
8.	15,886 5,899	16,575 6,778	2,333 1,677	12,344 4,446	6,661 5,892
9.	\$.08 .03	\$1.20 .80	\$4.00 1.25	\$6.54 5.79	\$8.91 4.06

USING ARITHMETIC IN BUYING AND SELLING

These problems show you how arithmetic is used in buying and selling.

1. Jack bought 5 packages of seeds at 7 cents a package. What change should he receive from a dollar?

2. Mary bought a can of peaches that weighed 1 pound 4 ounces. How many ounces did it weigh?

3. What do 4 oranges cost at 48 cents a dozen?

4. Potatoes are $1.60 a bushel. Mr. Smith wants only a peck. What does he pay for a peck?

5. A gallon of vinegar in bulk costs 28 cents. A quart bottle of vinegar costs 23 cents. How much less than a quart bottle of vinegar does a quart of vinegar, bought in bulk, cost?

6. Alice's mother paid $1.75 for 25 pounds of sugar. What was the price a pound?

7. A bushel of potatoes weighs 60 pounds. At $1.20 a bushel, how many pounds can I buy for 50 cents?

8. What is the cost of 25 yards of silk ribbon at 36 cents a yard?

9. At the school fair 325 tickets were sold at 25 cents each. What was received from the sale of tickets?

10. On an automobile trip Helen's father paid $2.94 for 14 gallons of gasoline. How much did he pay a gallon?

11. A grocer paid $30 for 75 dozen eggs. He sold them at 50 cents a dozen. How much more than he paid for the eggs did he receive a dozen?

12. Last winter Mr. Brown bought 10 tons of coal at $13.90 a ton. What did the coal cost him?

BUYING GOODS AT A SALE

1. The newspaper contained an advertisement of a sale at Johnson's store. Many articles were sold for less than the regular prices. For example, a boy's overcoat, regular price $28.25, was on sale at $22.50. How much less than the regular price was this?

2. The difference between the regular and the sale prices is called the *reduction.* Here is a list of things, giving the regular and the sale prices. Find the *reduction* on each item.

	Regular Price	Sale Price	Reduction
Boy's Cap	$1.25	$ .85	?
Rubbers	2.40	1.95	?
Girl's Coat	20.00	17.50	?
Bookcase	35.00	31.50	?
1 Large Rug	90.00	81.00	?
1 Table	45.50	40.95	?

3. What was the total reduction on a boy's cap and rubbers?

4. Mrs. Andrews bought 4 yards of $.45 calico for $.40 a yard. What was her total saving?

***5.** Why do stores have sales?

***6.** Why is it a good plan to buy at sales?

***7.** Look for advertisements of sales in your daily papers. Find the reductions on articles listed in them.

Subtract the following:

8. $115.30	**10.** $122.23	**12.** $66.83	**14.** $122.85
86.67	23.45	56.74	87.12
9. $92.58	**11.** $125.82	**13.** $137.84	**15.** $134.77
25.78	44.55	50.03	58.91

PRACTICE IN NAMING THE PROCESS TO USE IN SOLVING PROBLEMS

In finding answers to problems you must add, subtract, multiply, or divide. Sometimes you must use more than one of these processes. This exercise will give you practice in selecting the process to use.

1. How can you find how many dozen eggs there are in a basket, if you know the number of eggs it contains?

2. John picked berries on Monday and Tuesday. How can he find the total amount picked on the two days?

3. How would you find the cost of six yards of cloth if you knew the price a yard?

4. How can you find how much one boy weighs more than another, if you know each boy's weight?

5. How can you find the total number of children in a school if you know the number of children in each grade?

6. How can you find your increase in weight during a year?

7. If you work 8 hours for 25¢ an hour, how can you find what you have earned?

8. How can you find the number of gallons a 20-quart jar will hold?

9. How do you find one-half of $20?

10. If you have read 75 pages in a book, how can you find the number of pages still to be read?

11. Mary's mother is buying some cloth at 20¢ a yard. How will she find how much the cloth will cost her?

12. Butter costs 48¢ a pound. How can you find what 8 pounds will cost?

PROBLEMS WITH FACTS MISSING

In each of the following problems there is some fact missing which must be known before the problem can be solved. What fact is missing in each of the problems?

1. Mary bought bread at 12 cents a loaf. She gave the clerk 50 cents. What change should she receive?

2. Harry sold papers, for which he paid 2 cents each, at 3 cents each. How much was his gain on all of the papers that he sold?

3. Jack had 5 cents more than Harry. How much did Harry have?

4. Alice sold flowers for 10 cents a bunch. What did she receive for all of the flowers she sold?

5. Mary received $2.40 for taking care of Mrs. Jackson's baby. How much was she paid an hour?

6. Harry and Robert bought some marbles. Harry took 20 of them and Robert took the rest. How many did Robert take?

7. Helen had a garden, 40 feet long. What would it cost to build a fence around the garden if wire fencing cost 15 cents a foot?

8. In the fourth-grade room there were six rows of seats. How many seats were there in the room?

9. Harry paid 30 cents for some pencils. How much did he pay for each pencil?

10. Helen had read 60 pages in her new book. How many more pages does she still have left to read?

11. Alice had a savings bank with some money in it. She put in 50 cents more on Monday and 15 cents on Wednesday. How much did she then have in the bank?

A STUDY EXERCISE ON PROBLEM SOLVING

1. If John sold 50 morning papers and 20 evening papers, how many papers did he sell that day?

a. What is the question you are to answer?

b. In order to find this, what must you know?

c. Does the problem tell you this?

d. How can you find the answer to the question the problem asks?

Study the following problem carefully.

2. If John delivers 50 papers in the morning and 20 papers in the evening, how many papers does he deliver in 3 days?

a. What is the question you are to answer?

b. Before you can find the number of papers a boy delivers in three days, what must you know?

c. Does the problem tell you the number of papers John delivers in one day?

d. You can see that this problem has one step that problem **1** did not have. How can you find the number of papers John delivers in one day?

e. When you know the number of papers John delivers in one day, how can you find the number he delivers in three days?

3. Mary bought 3 oranges at 5¢ each. She gave the clerk $.25. What change should she receive?

a. What is the question you are to answer?

b. Before you can find the change Mary should receive, what must you know?

c. Does the problem tell you how much Mary spent?

d. How can you find how much Mary spent?

e. When you know how much Mary spent, how can you find the change Mary should receive?

USING MULTIPLICATION

Harry's father bought a 45-acre farm for $215 an acre. What did he pay for the farm?

$215 45 1 075 8 60 $9,675	First multiply 215 by 5. Then multiply 215 by 4. Be sure to place your figures correctly. Study the example at the left until you are sure that you understand the work.

Study the work in the examples below carefully. Then copy and work them.

(*a*)	(*b*)	(*c*)	(*d*)	(*e*)
56	256	$7.56	$.15	75
64	205	18	4	80
224	1 280	60 48	$.60	6,000
3 36	51 2	75 6		
3,584	52,480	$136.08		

MULTIPLICATION TEST

You should be able to work the examples in each row in seven minutes. Copy the examples and work carefully. Do not crowd your numbers. Be sure to check your work.

	a	*b*	*c*	*d*	*e*	*f*	*g*
1.	834 42	702 64	215 58	169 36	940 97	853 16	370 96
2.	647 31	206 28	832 93	794 27	903 15	583 73	506 38
3.	680 53	156 47	261 71	389 48	437 68	749 54	725 29
4.	764 708	947 509	598 807	496 406	718 908	586 905	578 603

PROBLEMS WITH TWO QUESTIONS

In the problems below, you must find the answer to the first question before you can answer the second question.

1. Harry bought a tablet for 5¢ and a pencil for 5¢.

a. How much did the pencil and the tablet cost?

b. What change would he receive if he gave the clerk a quarter?

2. Mary practiced her piano lesson for 30 minutes each morning except Sunday.

a. How many minutes did she practice in a week?

b. How many hours did she practice in a week?

3. A milkman had two large cans of milk. One contained 18 quarts and the other 14 quarts.

a. How many quarts of milk were there in the two cans?

b. How many gallons were there in the two cans?

4. John picked 15 quarts of blueberries on Monday and 18 quarts on Tuesday.

a. How many quarts did he pick in the two days?

b. If he sold them at 18¢ a quart, what did he receive?

5. Mary's mother bought 3 pounds of butter at $.48 a pound and a loaf of bread for 12 cents.

a. What did the butter cost her?

b. What did she spend for bread and butter?

6. Four bars of soap cost $.20.

a. What does 1 bar cost?

b. What will 10 bars cost?

7. Each day Henry sells 40 newspapers at 3 cents each. He pays only 2 cents for each paper.

a. How much does he gain on one paper?

b. How much does he gain on 40 papers?

SOLVING TWO-STEP PROBLEMS

1. The children in grades 3 and 4 used 25 half-pint bottles of milk each morning. The children in grades 1 and 2 used 43 half-pint bottles. What was the cost of the milk at 3¢ a bottle?

a. What am I to find?
The cost of the milk.

b. What facts are given?
Grades 3 and 4 used 25 half-pint bottles.
Grades 1 and 2 used 43 half-pint bottles.
The cost a bottle is 3¢.

c. How can I find the answer?
The number of bottles used times the price of one bottle equals the cost of the milk.
How many bottles were used? The fact is not given in the problem and must be found.

First Step	*Second Step*
25 bottles in grades 3 and 4 43 bottles in grades 1 and 2 68 bottles used	Finding the answer: 68 × \$.03 = \$2.04

d. Is the answer reasonable?

Answer questions ***a, b, c,*** and ***d*** about the two problems which follow:

2. The children in a school wish to raise money to buy some swings for the playground at a cost of \$85. They sold 258 tickets for a school fair at 10¢ each. How much must they still earn before they can pay for the swings?

3. One day Alice picked 15 bunches of flowers. She gave three of the bunches to her mother and sold the rest at 15 cents a bunch. What did she receive for the flowers she sold?

EVERYDAY ARITHMETIC

1. Ten boys gave 15¢ each and sent Don and Fred to buy a baseball. If the ball cost $1.35, how much money did they bring back?

2. In the morning David had 19 marbles. He lost 11 of them on the way to school. That afternoon his brother gave him 25 marbles. How many marbles did he then have?

3. A party of 14 boys and 11 girls hired a man to row them across a river. How many trips must the boatman make if he can take only five passengers across at one time?

4. Mr. Brown was driving his car home from a lake 12 miles from town. He had gone only 3 miles when the car broke down. The garage man charged him 50¢ a mile for towing him into town. How much did Mr. Brown pay to the garage man?

5. Eight members of a girls' canning club planned to can three kinds of fruit during a certain week in order to help fill a community barrel. Each girl was to can two jars of each kind of fruit. How many jars of fruit did the girls prepare for the barrel?

6. A party cost 60¢ and there were six children to pay for it. If Ruth's father gave her 25¢, how much did she have left after she paid her share of the cost of the party?

7. Frank had fifteen rabbits. Harold had six more than Frank. How many rabbits did the two boys have?

8. Frank sells 10 papers a day and makes 2¢ on each paper. How long will it take him to earn enough to buy a jackknife which costs 80¢?

9. Some girls were planning a hiking trip of 8 miles. They were to leave at 8 o'clock. If they walked, on the average, about two miles an hour, at what time would they reach home?

10. Pearl had 35¢. Louise had 10¢ less than Pearl. If Louise spent 15¢ for candy, how many cents would she have left?

11. A farmer paid 5¢ a bushel to two boys for picking up potatoes. Robert picked up 21 bushels and Fred picked up 17 bushels. How much money did the two boys earn?

12. William's father gave him a ball of kite string 600 feet long. William divided the string into three equal pieces. How many yards long was each piece?

13. Twenty-one Boy Scouts from one town and seventeen from another were camping at a lake. If only thirty-two could sleep in the cottages, how many slept in the tents?

14. Mary invited eighteen of her friends to a picnic. Seven could not come. In planning the boat rides, she was told by the man at the boathouse that she could have four people in each boat. How many boats did she need?

15. A class of 36 pupils was divided into four equal groups for a contest. If each one in Harry's group won 3 points the first day of the contest, find the number of points his group won.

16. Three brothers wished to visit their cousin on the other side of the town. If street-car fare cost 20¢ for each boy and they wanted 30¢ for spending money, how much money should they take with them?

17. The fifth-grade class in the Packer School wishes to buy 2 pictures that cost \$3.50 each. There is only \$5.20 in the class fund. How much more money must be earned before the class can buy the pictures?

MULTIPLYING BY LARGE NUMBERS

Most of the work that you will do in multiplication will be with small numbers. Sometimes you will have to multiply with large numbers. Study the work in the following examples. Then copy the examples and do the work. Compare your work with that below.

1.	2.	3.
6,178	4,531	4,531
432	608	6,008
12 356	36 248	36 248
185 34	2 718 6	27 186
2 471 2	2,754,848	27,222,248
2,668,896		

The work is like that which you have done in multiplying by two-place numbers. Notice where the partial products are placed.

Notice that in multiplying 4,531 by 608, the work in the multiplication by 0 is omitted. The 6 of 6 × 1 is written directly under the 6 by which you multiplied.

Find these products:

	a	*b*	*c*
4.	748 × 9,643	4,009 × 8,574	487 × 2,758
5.	302 × 6,458	978 × 3,120	596 × 4,936
6.	659 × 8,257	405 × 9,732	5,008 × 7,962

7. John's father shipped 485 hogs to market. He told John to figure the total weight of the hogs, taking 235 pounds as the average weight. What was the total weight?

8. Five hundred ninety-eight bushels of apples were sold for $2.65 a bushel. How much was received for the apples?

9. There were 16 rooms in Harvey's school. There were 40 desks in each room. Find the cost of all of the desks if each costs $6.58.

FINDING THE COST OF SCHOOL BOOKS AND SUPPLIES

Here are some problems which the children at the Calhoun School prepared for their arithmetic work:

1. Our reader costs \$.62. There are 39 children in our room. What is the total cost of supplying every child with a reader?

2. Our arithmetic books cost \$.79 each. What is the cost of the arithmetics for our class?

3. Our geography books cost 98¢ each. Find the cost of our 39 geographies.

4. Find the total cost of our readers, arithmetics, and geographies.

5. Each of us uses about four tablets a year. They cost 10¢ each. How much does our class spend for tablets?

6. Last year our school used 180 tons of coal. If coal costs \$4.75 a ton, how much was spent for coal?

7. In our school library there are 75 history books, 19 reference books, 387 story books, and 566 books of other kinds. How many books are in our library?

8. The Board of Education buys erasers for \$1.80 a dozen. How much does 1 eraser cost?

9. During the year we use about 3 quarts of ink. If the price of ink is 78¢ a quart, what is the cost of the ink for each child in our room?

10. In our school there are 658 new desks. They cost \$6.75 each. Find the total cost of the desks.

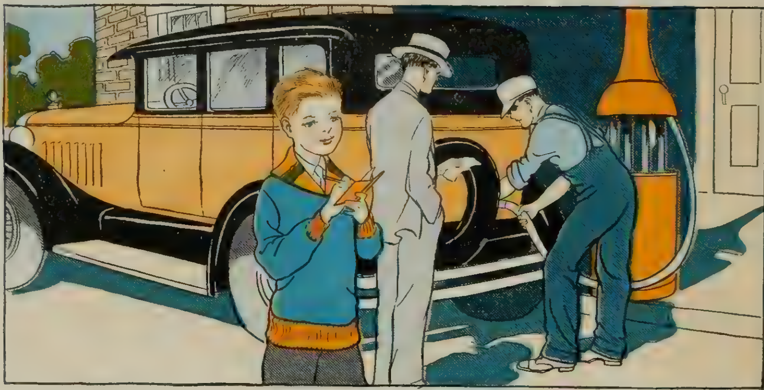
***11.** Find the cost of the readers and arithmetics used by your class.

***12.** Find how much the school board paid for the desks in your room.

MULTIPLICATION PRACTICE

If you find that you need practice in multiplication, work these examples carefully one row at a time. Be sure to do your work correctly. Check each example.

	a	*b*	*c*	*d*	*e*	*f*
1.	31 4	52 3	64 2	83 3	62 4	81 5
2.	56 5	84 4	96 6	37 7	28 6	49 8
3.	407 6	507 4	709 8	704 5	806 7	508 9
4.	342 4	426 3	516 6	637 8	489 7	958 9
5.	86 80	97 80	64 90	59 70	93 50	97 40
6.	75 32	79 49	53 89	93 62	64 89	42 57
7.	723 608	739 509	954 607	846 906	826 308	637 407
8.	912 426	463 798	758 259	907 578	586 674	948 913
9.	724 900	865 800	437 600	948 500	847 700	956 400
10.	\$5.60 75	\$8.45 24	\$9.80 25	\$.15 8	\$.06 15	\$.04 25



JACK'S AUTOMOBILE TRIP

Last summer Jack went on an automobile trip with his father. Jack was asked to keep a record of the money that was spent on the trip. Here are some of the problems that Jack had to solve.

1. On the first day Jack's father bought 16 gallons of gasoline at 24 cents a gallon. What did he pay for the gasoline?

2. On the second day he bought 15 gallons of gasoline. He paid the garage man $3.75 for the gasoline. What was the price a gallon?

3. How much more than on the first day did the gasoline cost a gallon on the second day?

4. On the third day they bought 13 gallons of gasoline at 26 cents a gallon, and on the fourth day 14 gallons at 25 cents a gallon. What did the gasoline bought on these two days cost?

5. How many gallons did they buy in all on the four days?

6. How much did they spend for gasoline in all?

7. On the first day they traveled 275 miles, on the second day 289 miles, on the third day 308 miles, and on the fourth day 249 miles. How long was their trip?

8. Below is a record of what Jack and his father paid for meals and rooms on the trip.

	Meals	Rooms
First Day	2.45	....
Second Day	3.20	3.25
Third Day	3.75	4.75
Fourth Day	2.60	1.75

How much did they spend for meals?

9. How much did they spend for rooms?

10. How much did they spend for meals and rooms?

11. Jack's father bought 8 quarts of oil at 25 cents a quart and spent $3.25 for repairs. What did he spend for oil and repairs?

*12. Find the total expenses of the trip.

Add: (5 minutes, not including copying.)

13.	14.	15.	16.	17.
$6.73	$5.49	$ .76	$4.79	$ .06
.86	4.97	8.57	6.74	8.55
7.55	26.53	.79	.08	9.99
9.99	.88	3.84	35.74	8.67

Subtract: (2 minutes, not including copying.)

18.	19.	20.	21.	22.
83,278	52,432	92,199	93,631	94,566
46,789	26,798	45,224	56,744	39,699

Multiply. (2 minutes, not including copying.)

23.	24.	25.	26.	27.
$3.75	$5.67	$8.27	$4.78	$4.98
26	58	64	39	75

MULTIPLYING BY NUMBERS ENDING IN ZEROS

1. How many pencils are there in 10 boxes if each box contains a dozen? How many are there in 100 boxes?

(Think: $10 \times 12 = 120$; $100 \times 12 = 1{,}200$.)

> *To multiply a whole number by 10, annex one zero to the number; to multiply by 100, annex two zeros; to multiply by 1,000, annex three zeros.*

Give the products:

	a	*b*	*c*
2.	$10 \times 25 =$	$100 \times 165 =$	$1{,}000 \times 30 =$
3.	$100 \times 18 =$	$1{,}000 \times 245 =$	$1{,}000 \times 465 =$
4.	$1{,}000 \times 23 =$	$10 \times 485 =$	$100 \times 850 =$
5.	$10 \times 80 =$	$100 \times 60 =$	$10 \times 760 =$

6. There are 20 rooms in a school. In each room there are 45 desks. How many desks are there in the school?

Think: $20 \times 45 = 10 \times 2 \times 45 = 10 \times 90 = 900$

> *To multiply a number by 20, first multiply by 2. Then annex one zero to the product. To multiply a number by 200, first multiply by 2. Then annex two zeros to the product.*
>
> **$200 \times 45 = 100 \times 2 \times 45 = 100 \times 90 = 9{,}000$**

Write a rule for multiplying by 30; 300; 40; 400; 4,000.

Find the products:

	a	*b*	*c*
7.	$20 \times 48 =$	$200 \times 56 =$	$50 \times 84 =$
8.	$40 \times 126 =$	$300 \times 148 =$	$60 \times 97 =$
9.	$70 \times 85 =$	$900 \times 32 =$	$300 \times 85 =$
10.	$80 \times 64 =$	$80 \times 125 =$	$800 \times 295 =$
11.	$50 \times 300 =$	$400 \times 97 =$	$90 \times 641 =$
12.	$400 \times 35 =$	$800 \times 96 =$	$3{,}000 \times 462 =$

FINDING DIFFICULTIES IN MULTIPLICATION

This exercise contains many different kinds of multiplication examples. Practice until you can work all of them correctly.

Set I

	a	*b*	*c*	*d*	*e*
1.	7 8	23 3	20 4	71 3	812 4
2.	340 2	601 5	400 3	2,010 6	504 7
3.	16 7	87 5	615 6	851 8	657 9

Set II

4.	32 21	412 21	230 22	612 30	312 400
5.	412 103	3,004 22	52 93	24 85	369 78
6.	849 490	708 796	9,005 465	9,080 823	143 596

Set III

7.	628 705	625 404	7,859 968	4,685 157	7,865 2,500
8.	\$.75 8	\$1.20 5	\$.09 7	\$2.25 79	\$16.00 64
9.	\$15.20 80	\$.60 90	\$.05 48	\$30.10 275	\$524 76

KEEPING AN ACCOUNT

The boys and girls in Tom's class held a candy sale every Friday afternoon for one month. Tom was appointed treasurer. He kept an account of all money that he received and paid out for the class. This is his account. Which side of the account contains the record of money received? of money paid out?

Candy Account

19—					19—				
Oct.	8	Candy sale	3	05	Oct.	8	Lewis Candy Co.	2	47
	15	Candy sale	4	45		14	Scott Sweet Shop	3	56
	21	Donation by class	3	70		20	Scott Sweet Shop	4	40
	22	Candy sale	5	50		26	Wilson Candy Co.	4	90
	29	Candy sale	6	20		30	Football	3	50
							Girls' basketball	3	50

1. How much cash does Tom's account show that the class received?

2. How much money was paid out?

3. How much was left at the end of the month?

4. At their sales the pupils sold all their candy bars at 5¢ each. How many did they sell on Oct. 8? Oct. 15? Oct. 22? Oct. 29?

5. Find how much they had to pay to the Lewis Candy Co. for each candy bar.

6. Did either the Scott Sweet Shop or the Wilson Candy Co. sell the bars for less than the Lewis Candy Co.?

7. On October 21, each member of the class gave a 10-cent donation to the class treasury. How many pupils were there in the class? Note the item for October 21.

FINDING DIFFICULTIES IN SHORT DIVISION

Each succeeding row of the following short division examples contains something new. Work each row. Use folded paper upon which to write your answers. Practice this exercise until you can work every example correctly.

	a	*b*	*c*	*d*	*e*	*f*
1.	3)6	2)8	6)48	7)63	9)81	8)32
2.	4)84	3)93	6)66	2)62	5)50	2)64
3.	5)155	6)366	7)427	4)368	3)279	2)184
4.	5)75	7)84	8)96	4)92	6)84	3)81
5.	7)94	6)79	5)71	8)90	3)74	2)51
6.	4)748	5)840	6)762	8)984	3)855	2)752
7.	9)163	5)175	6)396	8)656	7)679	4)348
8.	3)8,034	7)10,199	6)5,718	4)5,824	5)8,645	8)5,420
9.	5)515	8)848	2)616	7)756	6)756	3)1,518
10.	8)40,720	9)72,063	8)16,560	7)8,449	9)20,745	8)64,056
11.	6)595	8)697	6)764	4)651	3)583	7)648

Find:

12. $\frac{1}{4}$ of 36	**15.** $\frac{1}{5}$ of 40	**18.** $\frac{1}{3}$ of 27
13. $\frac{1}{8}$ of 64	**16.** $\frac{1}{6}$ of 54	**19.** $\frac{1}{2}$ of 14
14. $\frac{1}{9}$ of 54	**17.** $\frac{1}{7}$ of 42	**20.** $\frac{1}{9}$ of 36

21.	8)$.48	7)$1.26	4)$5.16	6)$8.58	3)$6.59	2)$4.00

SELLING VEGETABLES AND FRUIT

Harry and Mary had a small garden and some fruit trees. During August and September they sold fruit and vegetables to passing automobilists. Here are some arithmetic problems they had to work:

Harry and Mary in their garden

1. What must they charge for 12 dozen ears of corn at 25¢ a dozen?

2. A customer paid $2.75 for sweet corn. At 25¢ a dozen, how many dozen ears should he receive?

3. A customer bought carrots at 20¢ a bunch. He paid Harry $3.60. How many bunches should Harry give him?

4. They sold 25 boxes of tomatoes at 20¢ a box. What did they receive from the sale of tomatoes?

5. One morning they made a list of the fruits and vegetables they had for sale. That night they entered on the record the quantity of each kind of fruit and vegetables remaining unsold. Their record is shown on page 43.

a. How many of each kind were sold?

b. How much was received for the corn that was sold? for each of the other products that was sold?

c. How much money did their total sales amount to?

ON HAND MORNING	ON HAND NIGHT	SOLD	PRICE		AMT. REC'D
Corn, 18 doz.	3 doz.	?		18	?
Carrots, 24 bunches	2 bunches	?		15	?
Tomatoes, 8 bx.	0	?		20	?
Berries, 48 bx.	4 bx.	?		17	?
Apples, 6 bu.	0	?	1	75	?

REMAINDERS IN DIVISION

Below are two ways of expressing remainders in division. Their use is made clear by the following problems:

1. How many pencils at 5¢ each can be bought for 22¢?

4 and **2** cents remaining. **5)22**	You can buy 4 pencils and have 2 cents left.

2. Suppose you had 3 apples and wished to share them equally with a friend. You would each take 1 apple and cut the other apple into halves. You would each get $1\frac{1}{2}$ apples.

$1\frac{1}{2}$ $2\overline{)3}$	The division of the apple that was left after each person had one may be expressed by the fraction, $\frac{1}{2}$.

3. If you wished to share 7 Jonathan apples equally with three other people, how many would each person receive?

$1\frac{3}{4}$ $4\overline{)7}$ 4 3	After each person had one apple, there would be three apples to be divided. The division of these three apples can be expressed by the fraction, $\frac{3}{4}$. Each person would receive $1\frac{3}{4}$ apples.

When the quotient is expressed with a whole number and a fraction instead of with a remainder, the result is called the *exact quotient.*

Find the exact quotients.

	a	b	c	d	e
4.	$4\overline{)17}$	$5\overline{)8}$	$7\overline{)16}$	$9\overline{)29}$	$3\overline{)20}$
5.	$3\overline{)25}$	$6\overline{)47}$	$8\overline{)67}$	$2\overline{)11}$	$9\overline{)50}$

6. Mary cut a 25-inch ribbon into 6 equal pieces. How long was each piece?

7. How many 5-pound boxes of candy can be filled from a bag containing 28 pounds? How many pounds will be left over?

GIVING PRODUCTS MENTALLY

Practice on this exercise until you can give the products quickly and correctly. Practice giving them aloud and let a classmate check your answers.

	a	b	c	d
1.	$2 \times 14 =$	$6 \times 72 =$	$9 \times 39 =$	$3 \times 26 =$
2.	$7 \times 61 =$	$2 \times 86 =$	$4 \times 62 =$	$8 \times 93 =$
3.	$7 \times 27 =$	$5 \times 19 =$	$2 \times 25 =$	$4 \times 84 =$
4.	$6 \times 18 =$	$9 \times 17 =$	$5 \times 37 =$	$9 \times 92 =$
5.	$4 \times 73 =$	$2 \times 70 =$	$3 \times 84 =$	$3 \times 37 =$
6.	$6 \times 83 =$	$8 \times 62 =$	$2 \times 97 =$	$2 \times 36 =$
7.	$8 \times 58 =$	$5 \times 28 =$	$5 \times 46 =$	$2 \times 69 =$
8.	$7 \times 94 =$	$3 \times 48 =$	$7 \times 38 =$	$4 \times 49 =$
9.	$4 \times 95 =$	$3 \times 96 =$	$7 \times 35 =$	$2 \times 47 =$
10.	$9 \times 37 =$	$3 \times 59 =$	$9 \times 84 =$	$8 \times 47 =$
11.	$2 \times 58 =$	$6 \times 58 =$	$6 \times 49 =$	$5 \times 59 =$
12.	$3 \times 89 =$	$5 \times 47 =$	$6 \times 98 =$	$3 \times 47 =$

HOW TO FIND QUOTIENTS IN LONG DIVISION

The only difficult thing in long division is naming the quotient figures. Sometimes two or three figures must be tried before the correct quotient is found. Study the following examples carefully before you practice on the next exercise.

$21\overline{)64}$	Think: 21 is contained in 64 about as many times as 2 is contained in 6, or 3 times. Multiply 3 × 21 mentally; 63 is less than 64. Therefore 3 is the correct quotient figure.

$49\overline{)106}$	Think: 49 is less than 50; 49 is contained in 106 about as many times as 5 is contained in 10, or 2 times. Multiply 2 × 49 mentally; 98 is less than 106. Therefore 2 is the correct quotient figure, since 106 minus 98 is less than 49.

$36\overline{)96}$	Think: 3 is contained in 9 three times. Multiply 3 × 36 mentally; 108 is more than 96. Therefore 3 is not the correct quotient figure. Try 2. 2 × 36 is 72, which is less than 96. Therefore 2 is the correct quotient figure.

$39\overline{)197}$	Think: 39 is almost 40; 39 is contained in 197 about as many times as 4 is contained in 19, or 4 times. Multiply 4 × 39. The product, 156, is less than 197; but 197 minus 156 is more than 39. Therefore 4 is too small for the quotient. Try 5. 5 × 39 is 195, which is less than 197. Therefore 5 is the correct quotient figure.

PRACTICE IN NAMING QUOTIENTS

Practice on the four sets in this exercise until you can name the quotients correctly. Do not copy the examples. Write the quotient figures on a folded paper.

Set I

	a	*b*	*c*	*d*	*e*
1.	$29\overline{)58}$	$11\overline{)88}$	$32\overline{)64}$	$18\overline{)72}$	$21\overline{)84}$
2.	$22\overline{)66}$	$12\overline{)72}$	$41\overline{)82}$	$34\overline{)68}$	$33\overline{)99}$
3.	$11\overline{)48}$	$12\overline{)65}$	$14\overline{)76}$	$32\overline{)75}$	$45\overline{)96}$

Set II

4.	$74\overline{)296}$	$33\overline{)198}$	$54\overline{)324}$	$63\overline{)441}$	$81\overline{)648}$
5.	$72\overline{)360}$	$43\overline{)301}$	$83\overline{)415}$	$72\overline{)504}$	$94\overline{)658}$
6.	$34\overline{)239}$	$64\overline{)389}$	$96\overline{)676}$	$87\overline{)619}$	$57\overline{)295}$

Set III

7.	$24\overline{)120}$	$28\overline{)168}$	$36\overline{)216}$	$49\overline{)294}$	$58\overline{)468}$
8.	$78\overline{)624}$	$69\overline{)483}$	$47\overline{)282}$	$87\overline{)532}$	$39\overline{)156}$
9.	$16\overline{)129}$	$17\overline{)106}$	$14\overline{)128}$	$15\overline{)129}$	$18\overline{)131}$

Set IV

10.	$96\overline{)780}$	$67\overline{)357}$	$89\overline{)732}$	$52\overline{)390}$	$78\overline{)650}$
11.	$43\overline{)185}$	$58\overline{)440}$	$39\overline{)350}$	$62\overline{)451}$	$27\overline{)189}$
12.	$75\overline{)450}$	$32\overline{)128}$	$95\overline{)870}$	$46\overline{)257}$	$84\overline{)702}$

REVIEWING LONG DIVISION

Find the answers to the following examples and check. To check long division, multiply the quotient by the divisor and add the remainder if there is one. The result should equal the dividend.

	a	*b*	*c*	*d*
1.	21)683	31)674	21)795	21)6,552
2.	21)465	31)995	41)656	31)7,223
3.	21)884	31)372	31)785	41)8,692
4.	21)652	41)864	21)973	32)6,784
5.	21)1,092	32)1,344	62)2,184	42)13,608

DIVIDING WITH ZERO IN THE QUOTIENT

Find the quotients and check your work. Look out for 0's in the quotients.

	a	*b*	*c*	*d*
1.	43)12,986	53)21,465	15)6,105	84)25,536
2.	24)9,672	63)50,652	74)22,348	95)38,285
3.	39)15,795	46)230,276	49)29,743	95)570,665
4.	65)49,400	72)4,320,648	67)469,536	16)640,064
5.	37)111,185	25)21,000	314)65,312	231)106,260
6.	67)39,731	98)74,872	593)38,545	764)74,108

EARNING AND SAVING MONEY

The children in the Bancroft School earned money by doing different kinds of work. Here is a part of the record that Miss Allen posted on the bulletin board. It shows the amount of money earned by six different grades.

Grade	No. of Children	Amount Earned	Average Amt. a Pupil
Grade 1	39	$ 4.29	?
Grade 2	42	14.70	?
Grade 3	32	11.84	?
Grade 4	39	19.50	?
Grade 5	29	13.63	?
Grade 6	35	15.05	?
Total	?	?	

1. How much more than the first grade did the fourth grade earn?

2. How much less than the sixth grade did the second grade earn?

3. What was the average amount earned by each child in the first grade?

4. Find the average amount earned by each pupil in grade 2; in grade 3; in grade 4; in grade 5; in grade 6.

5. In which grade was the average amount earned a pupil largest?

6. How many children are there in the six grades?

7. What was the total amount they earned?

8. Jack, who is in grade 5, has a garden. During Thrift Week he sold 10 bunches of radishes at 5 cents a bunch and 15 heads of lettuce at 12 cents a head. What did he receive for the lettuce and radishes?

9. Mary sold 15 bouquets of sweet peas for $3.75. What did she receive for each bouquet?

DIFFICULTIES IN LONG DIVISION

The long division examples below are arranged in such a way that each row after the first has in it a new difficulty. After you have worked a row, tell what the new difficulty is.

	a	*b*	*c*	*d*	*e*
1.	12)144	11)121	21)441	32)384	61)671
2.	61)1,952	62)1,984	21)1,491	51)1,122	41)1,271
3.	41)3,444	71)6,248	61)2,501	42)1,008	81)5,508
4.	54)2,160	45)3,150	63)3,780	84)7,560	76)3,800
5.	63)2,394	82)2,050	44)1,100	83)2,241	72)4,208
6.	49)3,793	58)2,842	86)6,536	75)3,525	47)3,008
7.	11)1,221	12)3,852	22)5,082	23)4,899	21)6,594
8.	31)17,794	51)19,992	56)19,432	73)42,632	47)13,912
9.	85)26,180	62)31,568	39)31,434	78)55,224	94)37,788

10.	213)4,899	347)19,432	296)14,205	584)43,216
11.	75)96,531	48)75,961	56)42,963	92)76,983
12.	300)8,700	450)18,000	360)18,800	700)8,400

PRACTICE IN LONG DIVISION

You should be able to work four examples in 4 minutes.

1. 47)13,865	**3.** 39)31,395	**5.** 65)23,205	**7.** 16)7,824
2. 28)12,292	**4.** 98)79,237	**6.** 52)38,584	**8.** 74)62,604

HOUSEHOLD EXPENSES

Mrs. Johnson always kept a careful record of the money that she spent for rent, clothing, and other household expenses. The following problems tell about some of the expenses during the year.

1. Mrs. Johnson paid \$45 a month for rent. What was the total amount spent for rent during the year?

2. At the beginning of May she received an electric-light bill for \$3.56, a gas bill for \$2.98, and a telephone bill for \$3.50. What was the total amount of these bills?

3. At this rate what would be the total amount spent for electricity, gas, and telephone in one year?

4. The total amount spent for groceries in one year was \$496.80. What was the average a month?

5. Mr. Johnson's salary was \$3,600 a year. How much did he receive a month?

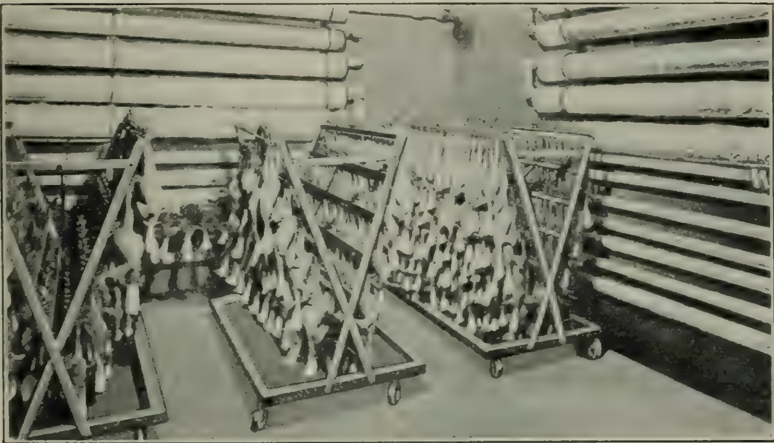
6. Mrs. Johnson subscribed for three magazines. One magazine cost \$4.00, another cost \$3.50, and the third cost \$1.75. Find the cost of the three magazines.

7. Mr. Johnson bought 11 tons of coal. The coal cost \$94.60. What was the average price a ton?

8. Mrs. Johnson bought 8 bushels of potatoes for \$14.00. How much did she pay a bushel?

9. One day Mrs. Johnson bought 3 pounds of meat at \$.45 a pound, and 2 pounds of lard at \$.22 a pound. What did she pay for the meat and lard?

10. One day she went to the grocery store and bought 2 pounds of butter at \$.45 a pound, a pound of coffee for \$.58, and 4 pounds of prunes at \$.25 a pound. What change should she receive from a five-dollar bill?



PRESERVING FOOD IN COLD STORAGE

In large cities great quantities of food are preserved in cold-storage plants. Foods of different kinds are stored in rooms in which the temperature is always kept the same. However, different temperatures are necessary for different foods. How do we measure temperature?

1. In a large storage plant there is one floor called the egg floor. In this room there were 30,000 cases of eggs. The temperature in the room is always kept at 29 degrees. How much below freezing is this? Use a thermometer to help you to find the answer.

2. One hot day in August the temperature out of doors was 102 degrees. How much lower than this was the temperature on the egg floor? Remember that the temperature on the egg floor is always kept at 29 degrees.

3. In each of the cases of eggs on the egg floor there were 30 dozen eggs. How many eggs were there in all?

4. On the average each person eats about two eggs a week. How many persons could be supplied for a week with the eggs on the egg floor?

5. What is the value of the eggs at 39 cents a dozen? What would be the value of the eggs at local prices? Cold storage eggs usually do not cost as much as fresh eggs. Why is this?

6. In the same storage house there is a room in which apples are stored. In this room the temperature is kept at 34 degrees. How many degrees warmer than the egg room is the temperature of the apple room?

7. Is the temperature in the apple room above or below freezing? how much? What would happen to the apples if the temperature fell to 15 degrees above zero?

8. In another room butter and dressed chickens are stored. The temperature here is always kept at 5 degrees below zero. How much lower than freezing is this?

9. How much colder than in the apple room is the temperature in the butter room?

10. How much warmer than the butter room is the egg floor?

11. The next room in the cold-storage plant is piled high with boxes of cheese. The temperature of this room is 28°. How much below freezing is this?

12. There are 1,624 pounds of cheese in the room. What is the value of this cheese at local prices?

13. Make a sketch of a thermometer. Show the zero point; the temperature at which water freezes; the temperature of each of the rooms of the cold-storage plant mentioned in the above problems.

EVERYDAY ARITHMETIC

Find the answers to as many of these problems as you can in 20 minutes. They are all two-step problems.

1. Jack had 8 rabbits, and Harry had 6 more than Jack. How many rabbits did the two boys have?

2. George bought a pound of sugar for 7¢, and a package of salt for 10¢. What change should he receive from a quarter?

3. Mary bought 6 red ribbons and 5 blue ribbons. Find the total cost if each ribbon was priced at 5¢.

4. John picked 7 quarts of berries on Monday and 5 quarts on Tuesday. He received 60¢ for his work. What did he receive a quart?

5. A grocer had two boxes of apples, each containing 60 pounds. From one of them he sold 30 pounds. How many pounds did he have left?

6. Harry picked 7 bouquets of sweet peas. He gave three bouquets to his mother and sold the rest for 10¢ each. What did he receive for his flowers?

7. A farmer went to market with 40 bushels of potatoes. He sold 30 bushels at $2 a bushel and the remainder he sold for $18. What did he receive a bushel for the remainder?

8. John had $10 in his savings account. He worked 4 hours on Saturday at $.25 an hour. He put his wages in the savings bank. What did he then have in the bank?

9. George bought three loaves of bread for 9¢ a loaf. Find the change he received from a half dollar.

10. An automobilist bought 5 gallons of gasoline at 20¢ a gallon. Find the cost of gasoline a mile if he drove 100 miles with this supply.

11. A grocer bought 5 bushels of potatoes which he sold at \$.35 a peck. What did he receive for the potatoes?

12. How many gallons are there in two tanks, one of which contains 5 gallons and the other 10 quarts?

13. Apples were on sale at 2 for 10¢. An orange cost 6¢. How much more than an apple did an orange cost?

14. Find the cost of 3 pecks of potatoes, if the cost of one bushel is \$2.00.

15. Find the cost of $\frac{1}{2}$ peck of apples, if the cost of one bushel is \$1.60.

16. A farmer had an orchard containing 100 trees. Thirty of them were apple trees, and 15 were plum trees. The rest were cherry trees. How many cherry trees were there?

NAMING PROCESSES USED TO SOLVE PROBLEMS

Name the processes that you would use to find the answers to the following problems. Do not work the problems.

Write ***a*** for add, ***s*** for subtract, ***m*** for multiply, and ***d*** for divide.

Example: How do you find the cost of 25 books if 1 book cost 48 cents? *m*

1. Mary gathered 60 eggs for her grandmother. How do you find how many dozen she gathered? ____

2. Jack weighed 68 pounds and Helen weighed 81 pounds. How do you find how much less than Helen Jack weighed? ____

3. Harry was paid 2 cents a quart for picking strawberries. If he picked 48 quarts in all, how do you find how much he received for picking them? ____

4. Mrs. Smith bought three chickens. One weighed 4 pounds, one weighed 3 pounds, and one weighed 5 pounds. How do you find the total weight of the three chickens? ——

5. Helen wishes to buy a doll for $1.25. If she has only $.60, how do you find how much more she must have before she can buy the doll? ——

6. How do you find the number of handkerchiefs that can be bought for $1.00 if handkerchiefs cost $.10 each? ——

7. Harry had a newspaper route. On Monday he collected $4.75 from his customers, on Tuesday he collected $8.55, and on Wednesday $6.60. How do you find how much he collected in all? ——

8. Jack's father raised 25 bushels of potatoes in his garden. If there are 4 pecks in a bushel, how do you find the number of pecks of potatoes he raised? ——

9. James went to the store with a $1.00 note. His bill for groceries was $.70. How do you find the change he should receive? ——

10. Helen is 61 inches tall and Mary is 57 inches tall. How do you find how much taller than Mary Helen is? ——

11. Helen's mother baked 10 pans of cookies, each pan containing 12 cookies. How do you find how many cookies she baked? ——

12. The grocer had 8 bags of sugar which weighed 800 pounds in all. How do you find the weight of one bag? ——

Now work the problems and check your work. In how many examples were you able to give the correct process?

PROBLEMS WITH NUMBERS MISSING

In the problems below some facts are missing. Supply the facts and then solve the problems. Be sure that the numbers you supply are reasonable.

1. A garden is —— feet long and —— feet wide. What is the distance around the garden?

2. The arithmetic class in the fifth grade begins at —— o'clock and ends at —— o'clock. How long does the class last?

3. Harry's father sold —— bushels of apples at —— a peck. What did he receive for the apples?

4. Alice's mother bought a bushel of potatoes. When she reached home, she weighed them on her scales and found that they weighed only —— pounds. How much less than a bushel did they weigh? (A bushel of potatoes weighs 60 pounds.)

5. Mary bought —— yards of cloth for a dress. The cloth cost ——. What was the price of the cloth a yard?

6. Harry picked —— quarts of strawberries on Monday, —— quarts on Tuesday, —— quarts on Wednesday, and —— quarts on Thursday. He was paid —— cents a quart for picking them. What did he earn in all?

7. Alice and John belonged to a pig club. When their pigs were weighed at the fair, Alice's pig weighed —— pounds and John's pig weighed —— pounds. How much more than John's pig did Alice's pig weigh?

8. The distance around the block in which Harry lives is —— yards. How much less than a mile is this?

9. Julia went to the store and bought —— quarts of milk at —— cents a quart and —— pounds of butter at —— cents a pound. How much did she pay the clerk?

PRACTICE TESTS IN THE FUNDAMENTALS

You should be able to work the examples in the following sets and to check your work in the time allowed. Copy the examples before counting time.

Addition Test (8 minutes)

1.	2.	3.	4.	5.	6.
249	456	447	666	623	197
787	645	356	745	729	783
456	584	995	590	232	917
865	636	625	913	943	732
798	889	877	489	287	118
839	979	342	528	309	294

Subtraction Test (5 minutes)

1. 7,014	4. 8,165	7. 7,003	10. 12,968
4,689	6,597	2,139	4,459
2. 12,337	5. 13,411	8. 11,933	11. 12,410
6,869	7,433	4,358	7,679
3. 15,412	6. 14,124	9. 15,211	12. 8,666
6,769	5,434	7,825	2,689

Multiplication Test (9 minutes)

1. 672	3. 249	5. 128	7. 731	9. 359	11. 536
48	39	75	62	84	93
2. 495	4. 429	6. 841	8. 817	10. 637	12. 658
57	26	480	903	750	602

Long Division Test (10 minutes)

1. 41)656	4. 61)2,745	7. 80)5,840	10. 73)3,212
2. 49)1,127	5. 58)4,292	8. 27)2,538	11. 76)4,332
3. 34)23,868	6. 53)13,588	9. 48)14,688	12. 45)15,750

PROBLEM SCALE I

This scale will help you to discover how well you can find the answers to problems. The standards will help you to check your accuracy in solving problems.

Standards	
Excellent	9 or 10 correct
Good	7 or 8 correct
Fair	5 or 6 correct
Unsatisfactory	0 to 4 correct

1. John has $2.75. Harry has $4.10. How much more must John have before he has as much as Harry?

2. Mary bought 4 dozen pens. How many pens did she buy?

3. How many pounds of meat at $.40 a pound can you buy for $3.60?

4. Mary practices on her piano every week day for 25 minutes. How many minutes does she practice in a week?

5. Baseballs have been selling at $1.50 each. They are now reduced 15 cents. Donald buys a ball. He pays the clerk with a $2 bill. What change should he receive?

6. The fifth grade of the Marcy School is planning a picnic. There are 19 boys and 16 girls in the grade. They decide to allow 2 sandwiches for each pupil. How many sandwiches are needed for the picnic?

7. Mary bought a loaf of bread for 15¢ and 2 quarts of milk at 11¢ a quart. How much must she pay the clerk?

8. Elizabeth bought five yards of lace at 25¢ a yard. She gave the clerk a $5 bill. What change should she receive?

9. Three boys received $2.70 for raking Mrs. Johnson's big lawn. John decided to buy tennis balls with his share. If the balls cost 45 cents each, how many did he buy?

10. Mrs. Smith buys 4 bars of soap for a quarter. At this rate what do a dozen bars cost?

CHAPTER II

EVERYDAY USES OF FRACTIONS

1. Harry lived $\frac{1}{2}$ mile and Jack $\frac{1}{4}$ mile from school. Which boy had to walk the greater distance to school?

2. Mary's mother asked her, "Which would you rather have, $\frac{1}{2}$ of a pie or $\frac{3}{4}$ of a pie?" Mary said, "$\frac{3}{4}$ of a pie." Show that Mary chose the larger amount.

3. Mary was $52\frac{1}{8}$ inches tall and Kate was $52\frac{7}{8}$ inches tall. Which was the taller and how much?

4. What part of a quart is a pint?

5. How many minutes less than $\frac{1}{2}$ hour is $\frac{1}{4}$ hour?

6. Harry had two apples. One weighed $\frac{1}{2}$ pound and the other weighed $\frac{3}{8}$ pound. Which apple was the larger?

7. How much more than a quarter is a half dollar?

8. Mary's mother had only $\frac{3}{4}$ yard of cloth. How much less than a whole yard was this?

9. How many $\frac{1}{2}$-pound packages of raisins can be filled from a 2-pound package?

10. Harry had an allowance of $2.00 a week. He planned to spend $\frac{1}{4}$ of it for car fare, $\frac{1}{5}$ for entertainment, $\frac{1}{2}$ for lunches, and to put the remainder into the bank. How much did he plan to spend for car fare? for entertainment? for lunches? How much would he have left to put into the savings bank?

TERMS OF FRACTIONS

The parts of a fraction are called the *terms* of the fraction. In the fraction $\frac{3}{4}$, 3 is called the *numerator* and 4 the *denominator*.

$\frac{3}{4}$ ←numerator / ←denominator

What is the numerator of each of these fractions? What is the denominator?

$\frac{3}{5}$, $\frac{7}{8}$, $\frac{2}{3}$, $\frac{1}{2}$, $\frac{4}{7}$, $\frac{7}{9}$, $\frac{5}{6}$, $\frac{1}{3}$, $\frac{3}{7}$, $\frac{3}{4}$, $\frac{4}{9}$, $\frac{5}{8}$.

THE MEANING OF NUMERATOR AND DENOMINATOR

1. Into how many equal parts is this circle divided? One of the equal parts is what part of the circle?

2. How many fourths are shaded? How many fourths are not shaded?

3→The number of equal parts taken or shaded.
4→The number of equal parts into which the circle is divided.

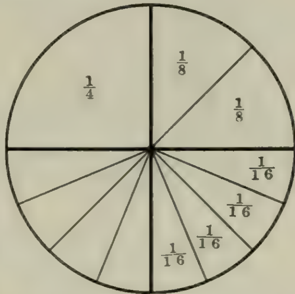
The *denominator* of a fraction tells into how many equal parts the quantity is divided.

The *numerator* of a fraction tells how many of the equal parts are taken.

3. What part of this circle is shaded?

4. If a pie is cut into six equal parts and five of them are eaten, what part of the pie will be eaten? Write the fraction. Into how many equal parts was the pie cut? What term of the fraction tells you this? How many of these parts were eaten? What term of the fraction tells you this?

CHANGING FRACTIONS TO LOWER TERMS



Study the drawing at the right.

Show that:

$\frac{1}{4} = \frac{2}{8}$ $\quad \frac{1}{4} = \frac{4}{16}$ $\quad \frac{1}{4} = \frac{2}{8} = \frac{4}{16}$

You see by the drawing that $\frac{1}{4}$, $\frac{2}{8}$, and $\frac{4}{16}$ all have the same value but are written in different ways. When $\frac{2}{8}$ is found in the answer of an example, it is always changed to $\frac{1}{4}$, because $\frac{1}{4}$ is a simpler fraction.

To change $\frac{2}{8}$ to $\frac{1}{4}$, divide both terms of the fraction by 2.

$$\boxed{\frac{2 \div 2}{8 \div 2} = \frac{1}{4}}$$

You see from the drawing that $\frac{2}{8} = \frac{1}{4}$.

To change $\frac{4}{16}$ to $\frac{1}{4}$, divide both terms of the fraction by 4. The drawing shows that $\frac{4}{16} = \frac{1}{4}$.

$$\boxed{\frac{4 \div 4}{16 \div 4} = \frac{1}{4}}$$

You see that *dividing both terms of a fraction by the same number does not change the value of the fraction.*

Changing a fraction like $\frac{2}{8}$ to $\frac{1}{4}$ is called *reducing the fraction to lower terms.*

Can the terms of $\frac{1}{4}$ be divided by any other number except 1?

When the terms of a fraction cannot be divided by any number except 1, the fraction is in its *lowest terms.*

1. Is $\frac{8}{16}$ reduced to lowest terms? How can you tell?

2. Is $\frac{7}{8}$ reduced to lowest terms? How can you tell?

3. Change the following fractions to lowest terms.

$\frac{6}{8}$	$\frac{4}{8}$	$\frac{8}{16}$	$\frac{10}{16}$	$\frac{10}{20}$	$\frac{3}{6}$	$\frac{4}{6}$	$\frac{14}{16}$
$\frac{8}{10}$	$\frac{2}{8}$	$\frac{6}{9}$	$\frac{5}{20}$	$\frac{6}{16}$	$\frac{8}{12}$	$\frac{16}{32}$	$\frac{15}{60}$
$\frac{6}{15}$	$\frac{8}{20}$	$\frac{9}{12}$	$\frac{6}{10}$	$\frac{9}{18}$	$\frac{8}{32}$	$\frac{3}{9}$	$\frac{10}{12}$

PICTURING FRACTIONAL PARTS

A

1. Into how many parts is this square divided?

2. What part of the whole square is each of the smaller parts?

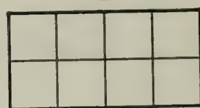
3. What fractional part of this square is colored orange?

Think: Two of the small parts, or $\frac{2}{16}$, are colored.
$\frac{2}{16} = \frac{1}{8}$ Therefore $\frac{1}{8}$ of the square is colored.

4. What fractional part will be colored if 4 small parts are colored? Prove with a drawing.

5. What part of the square will be colored when 8 small parts are colored? Prove with a drawing.

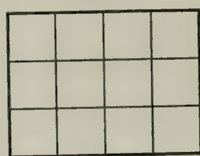
B



6. What fraction of the square will be colored when 12 small parts are colored?

7. How many parts must be colored to shade $\frac{7}{8}$ of *A?*

C



8. How many parts of *B* must you color if you color $\frac{1}{2}$ of it? $\frac{1}{4}$ of it? $\frac{1}{8}$ of it? $\frac{3}{4}$ of it? $\frac{7}{8}$ of it? $\frac{5}{8}$ of it?

9. Draw a figure like *C*. Color $\frac{1}{4}$ of it.

10. Draw another figure like *C*. Color $\frac{2}{3}$ of it.

FINDING FRACTIONS OF EQUAL VALUE

1. Which of the following fractions are equal to $\frac{1}{2}$?

$\frac{2}{4}$; $\frac{2}{8}$; $\frac{3}{9}$; $\frac{5}{10}$; $\frac{6}{8}$; $\frac{3}{12}$; $\frac{3}{6}$; $\frac{2}{16}$; $\frac{5}{20}$; $\frac{4}{8}$; $\frac{9}{12}$; $\frac{9}{18}$; $\frac{4}{12}$; $\frac{3}{24}$; $\frac{2}{2}$; $\frac{6}{12}$; $\frac{4}{16}$; $\frac{10}{20}$; $\frac{4}{4}$; $\frac{5}{20}$; $\frac{15}{20}$; $\frac{12}{24}$; $\frac{3}{3}$; $\frac{8}{24}$; $\frac{8}{16}$; $\frac{12}{16}$; $\frac{7}{7}$.

2. Which of the above fractions are equal to $\frac{1}{4}$? $\frac{1}{3}$? $\frac{1}{6}$? $\frac{3}{4}$? 1?

FRACTIONS IN THE SCHOOLROOM

1. Mary's school begins at half past eight. How many minutes after 8 is this?

2. Recess comes at a quarter past 10. How many minutes after 10 is this?

3. The arithmetic class period is 45 minutes long. What part of an hour is this?

Think: 1 minute = $\frac{1}{60}$ hr. 45 minutes = $\frac{45}{60}$ hr. = ?

4. The writing period is 15 minutes long. What fraction of an hour is this?

5. On a spelling test of 20 words, Mary misspelled 5 words. What fraction of the words did she spell incorrectly?

6. In Mary's room are 40 pupils, twenty-five of whom are boys. What fraction are boys? What fraction are girls?

7. One-half of the 40 children are members of the Junior Red Cross. How many of the children are members?

CHANGING TO FRACTIONAL PARTS

Practice with these exercises until you can do the work quickly and without a mistake.

1. What part of a foot is each of the following?

3 in. 5 in. 6 in. 7 in. 8 in. 9 in. 10 in.

2. What part of a gallon is each of the following?

1 qt. 2 qt. 3 qt.

3. What part of a bushel is each of the following?

24 qt. 28 qt. 12 qt. 2 pk. 3 pk. 6 qt.

4. What part of an hour is each of the following?

1 min. 10 min. 15 min. 20 min. 30 min. 35 min.
40 min. 45 min. 50 min. 55 min. 25 min. 5 min.

PARTS AND WHOLES

1. These lines are divided into $\frac{1}{4}$ inches. How many $\frac{1}{4}$ inches are in the first line? the second line? the third line?

2. Measure the lines. Which line is 1 inch long? Which is less than 1 inch long? Which is more than 1 inch long?

3. Is $\frac{4}{4}$ inch equal to 1 inch?

4. How much longer than an inch is $\frac{5}{4}$ inches? You can see that $\frac{5}{4}$ in. $=$ 1 in. $+$ $\frac{1}{4}$ in. We write this $1\frac{1}{4}$ inches.

5. How much more than an inch is $1\frac{3}{4}$ inches?

6. Cut three oranges in halves. Take three of the halves. How much more than one orange is $\frac{3}{2}$ of it?

7. Take four of the halves. How many oranges do they make? $\frac{4}{2} = ?$

8. If you take five of the halves, how much more than 2 oranges will you have? $\frac{5}{2} = 2 + ?$

9. Cut the three oranges into fourths. If you take 8 of the fourths, how many oranges will you have? $\frac{8}{4} = ?$

10. If you take 6 of the fourths, how many oranges will you have? $\frac{6}{4} = ?$

11. 1 = ? halves; ? thirds; ? fourths; ? fifths; ? sixths.

12. 2 = ? halves; ? thirds; ? fourths; ? fifths; ? sixths.

13. 3 = ? halves; ? thirds; ? fourths; ? fifths; ? sixths.

14. 4 halves = ? wholes. **15.** 6 halves = ? wholes.

KINDS OF NUMBERS

1. Mary practiced on the piano 1 hour in the morning and $\frac{1}{2}$ hour in the afternoon. How long did she practice?

1 and $\frac{1}{2}$ hours are written: $1\frac{1}{2}$ hours.

$2\frac{1}{4}$ hours is read: two and one-fourth hours.

2. If she practiced $\frac{1}{2}$ hour on Monday, $\frac{1}{2}$ hour on Tuesday, and $\frac{1}{2}$ hour on Wednesday, how many half hours did she practice?

$$\frac{1}{2} + \frac{1}{2} + \frac{1}{2} = ?$$

Three halves are written $\frac{3}{2}$.

Numbers like 1, 7, 25, and 96 are called *whole numbers*, or *integers.*

Numbers like $1\frac{1}{2}$, $2\frac{3}{4}$, and $56\frac{7}{8}$ are called *mixed numbers.*

Fractions like $\frac{1}{2}$, $\frac{1}{3}$, or $\frac{7}{8}$, are called *proper fractions.* Their numerators are smaller than their denominators.

Fractions like $\frac{3}{2}$, $\frac{4}{4}$, or $\frac{16}{3}$ are called *improper fractions.* Their numerators are equal to or larger than their denominators.

3. Classify the numbers below into four groups: whole numbers; mixed numbers; proper fractions; improper fractions.

$8\frac{1}{2}$	6	$\frac{7}{8}$	$\frac{10}{9}$	$1\frac{1}{5}$	75	$\frac{7}{7}$	$\frac{12}{5}$	$65\frac{1}{4}$
$2\frac{1}{6}$	8	$\frac{1}{10}$	$\frac{5}{2}$	89	$\frac{6}{9}$	$7\frac{1}{8}$	$\frac{5}{4}$	$\frac{9}{8}$
$\frac{4}{4}$	$\frac{3}{3}$	27	$\frac{5}{8}$	$3\frac{1}{3}$	$\frac{4}{5}$	36	$\frac{12}{12}$	$\frac{20}{5}$
$3\frac{1}{2}$	$\frac{6}{7}$	$\frac{8}{8}$	94	$4\frac{1}{12}$	$\frac{8}{11}$	$\frac{13}{5}$	0	10
$\frac{5}{4}$	$25\frac{1}{6}$	$\frac{7}{6}$	100	$\frac{15}{16}$	$5\frac{9}{10}$	$\frac{16}{15}$	27	$\frac{2}{3}$

4. How much more than 2 is

$2\frac{1}{2}$? $2\frac{3}{4}$? $2\frac{2}{5}$? $2\frac{1}{8}$? $2\frac{7}{8}$? $3\frac{1}{2}$? $2\frac{2}{2}$? $1\frac{2}{2}$? $3\frac{2}{2}$?

5. Write a mixed number larger than 4 and less than 5.

6. Write a fraction smaller than $\frac{1}{2}$.

CHANGING IMPROPER FRACTIONS TO WHOLE OR MIXED NUMBERS

1. Harry worked $\frac{3}{4}$ hour in the garden, $\frac{1}{4}$ hour raking the lawn, and $\frac{1}{4}$ hour in the basement. How long did he work in all?

$\frac{3}{4}+\frac{1}{4}+\frac{1}{4}=\frac{5}{4}$. $4\overline{)5}$ = $1\frac{1}{4}$	To change $\frac{5}{4}$ to a mixed number, think of $\frac{5}{4}$ as a division example. Divide the numerator by the denominator.

Study the following examples carefully:

$\frac{7}{3} = 3\overline{)7} = 2\frac{1}{3}$ $\qquad$ $\frac{9}{5} = 5\overline{)9} = 1\frac{4}{5}$

$\frac{6}{4} = 4\overline{)6} = 1\frac{2}{4} = 1\frac{1}{2}$ $\qquad$ $\frac{10}{4} = 4\overline{)10} = 2\frac{2}{4} = 2\frac{1}{2}$

$\frac{8}{4} = 4\overline{)8} = 2$ $\qquad$ $\frac{15}{5} = 5\overline{)15} = 3$

2. Change the following to whole or mixed numbers:

$\frac{6}{5}$; $\frac{9}{4}$; $\frac{3}{2}$; $\frac{6}{3}$; $\frac{5}{4}$; $\frac{12}{8}$; $\frac{10}{8}$; $\frac{14}{6}$; $\frac{8}{3}$; $\frac{4}{2}$; $\frac{14}{4}$.

Whenever the answer of a problem or example is in the form of an improper fraction, it should be changed to a whole or mixed number. The fractional part of mixed numbers should be reduced to lowest terms. Change these improper fractions to whole or mixed numbers.

	a	*b*	*c*	*d*	*e*	*f*	*g*
3.	$\frac{8}{5}$	$\frac{9}{3}$	$\frac{8}{2}$	$\frac{5}{5}$	$\frac{7}{2}$	$\frac{8}{6}$	$\frac{9}{6}$
4.	$\frac{10}{6}$	$\frac{15}{9}$	$\frac{16}{10}$	$\frac{17}{4}$	$\frac{16}{10}$	$\frac{20}{8}$	$\frac{27}{8}$
5.	$\frac{25}{15}$	$\frac{36}{11}$	$\frac{45}{10}$	$\frac{27}{15}$	$\frac{18}{12}$	$\frac{9}{9}$	$\frac{18}{8}$

Which of the following are correct? Which are incorrect?

6. $\frac{7}{4} = 1\frac{3}{4}$	**8.** $\frac{12}{3} = 4$	**10.** $\frac{16}{12} = 1\frac{1}{4}$
7. $\frac{11}{8} = 1\frac{3}{8}$	**9.** $\frac{20}{9} = 2\frac{4}{9}$	**11.** $\frac{45}{7} = 6\frac{4}{7}$

FINDING PRICES

1. If 4 pounds of sugar cost 18¢, what is the cost a pound?

2. Later in the year the cost of 4 pounds of sugar was 22¢. Find the cost a pound.

3. A dozen oranges cost 52¢. Find the cost of 1 orange.

4. A 24-box crate of strawberries cost $3.00. Find the cost a box.

Find the answers and reduce fractions to lowest terms:

1.	$46 \div 4 =$	**6.**	$714 \div 9 =$	**11.**	$914 \div 8 =$
2.	$75 \div 6 =$	**7.**	$725 \div 10 =$	**12.**	$525 \div 9 =$
3.	$214 \div 4 =$	**8.**	$915 \div 9 =$	**13.**	$818 \div 6 =$
4.	$634 \div 8 =$	**9.**	$786 \div 12 =$	**14.**	$166 \div 8 =$
5.	$414 \div 4 =$	**10.**	$484 \div 6 =$	**15.**	$452 \div 8 =$

SOME HOUSEHOLD ARITHMETIC

One night the Jones family was discussing the cost of living. Here are some of the problems that came up:

1. Our telephone bill is $3.00 a month. How much is this a year?

2. Counting 30 days as a month, what is the cost of the telephone a day?

3. Using the telephone rates where you live, find the cost a year and the cost a day.

4. Our electric-light bill last month was $4.65. At this rate, what will the electric light bill for a year be?

***5.** Find the cost of the electricity in some home in your community for some month. Then find the cost for a day.

6. Our gas bill was $3.21 last month. At this rate, what will we spend for gas for the year? for a day?

KINDS OF FRACTIONS

Fractions like $\frac{3}{4}$ and $\frac{1}{4}$ are called *like fractions* because they have like denominators.

Fractions like $\frac{1}{2}$ and $\frac{1}{4}$ are called *unlike fractions* because they have unlike denominators.

Which of the following pairs of fractions are like fractions? Which are unlike fractions?

	a	*b*	*c*	*d*	*e*	*f*
1.	$\frac{1}{2}, \frac{1}{2}$	$\frac{1}{3}, \frac{1}{5}$	$\frac{1}{4}, \frac{1}{8}$	$\frac{1}{8}, \frac{3}{8}$	$\frac{1}{4}, \frac{3}{4}$	$\frac{1}{5}, \frac{1}{10}$
2.	$\frac{1}{4}, \frac{1}{5}$	$\frac{2}{6}, \frac{5}{6}$	$\frac{7}{8}, \frac{3}{8}$	$\frac{7}{9}, \frac{2}{3}$	$\frac{8}{10}, \frac{7}{11}$	$\frac{4}{5}, \frac{5}{6}$

ADDING EASY FRACTIONS

There are five types of examples in adding like fractions. Study each type carefully.

$$
\begin{array}{lllll}
\textit{a}\ \frac{1}{3} & \textit{b}\ \frac{1}{8} & \textit{c}\ \frac{1}{4} & \textit{d}\ \frac{4}{5} & \textit{e}\ \frac{3}{4} \\
\underline{\ \ \frac{1}{3}\ } & \underline{\ \ \frac{3}{8}\ } & \underline{\ \ \frac{3}{4}\ } & \underline{\ \ \frac{3}{5}\ } & \underline{\ \ \frac{3}{4}\ } \\
\ \ \frac{2}{3} & \ \ \frac{4}{8} = \frac{1}{2} & \ \ \frac{4}{4} = 1 & \ \ \frac{7}{5} = 1\frac{2}{5} & \ \ \frac{6}{4} = 1\frac{2}{4} = 1\frac{1}{2}
\end{array}
$$

Copy the examples and work them with your books closed.

Practice with the sets of examples below until you can give the sums reduced to lowest terms without mistakes.

Set I

$\frac{1}{3}$	$\frac{1}{4}$	$\frac{1}{8}$	$\frac{3}{8}$	$\frac{1}{5}$	$\frac{1}{6}$	$\frac{3}{6}$	$\frac{1}{10}$	$\frac{4}{9}$
$\frac{1}{3}$	$\frac{2}{4}$	$\frac{2}{8}$	$\frac{2}{8}$	$\frac{3}{5}$	$\frac{4}{6}$	$\frac{2}{6}$	$\frac{6}{10}$	$\frac{3}{9}$

Set II

$\frac{1}{4}$	$\frac{3}{8}$	$\frac{1}{8}$	$\frac{1}{6}$	$\frac{3}{8}$	$\frac{3}{10}$	$\frac{1}{6}$	$\frac{5}{12}$	$\frac{4}{9}$
$\frac{1}{4}$	$\frac{1}{8}$	$\frac{5}{8}$	$\frac{1}{6}$	$\frac{3}{8}$	$\frac{1}{10}$	$\frac{2}{6}$	$\frac{1}{12}$	$\frac{2}{9}$

Set III

$\frac{1}{8}$	$\frac{3}{4}$	$\frac{1}{2}$	$\frac{5}{6}$	$\frac{4}{5}$	$\frac{2}{3}$	$\frac{7}{8}$	$\frac{2}{5}$	$\frac{3}{4}$
$\frac{7}{8}$	$\frac{1}{4}$	$\frac{1}{2}$	$\frac{3}{6}$	$\frac{2}{5}$	$\frac{2}{3}$	$\frac{5}{8}$	$\frac{3}{5}$	$\frac{2}{4}$

ADDING MIXED NUMBERS

1. Harry worked in his garden $3\frac{1}{4}$ hours on Wednesday and $2\frac{1}{4}$ hours on Thursday. How long did he work in the two days?

> Think: $3\frac{1}{4}$ hr. + $2\frac{1}{4}$ hr. = ? hr.
>
> To find the answer you must add two mixed numbers.
>
> $$\begin{array}{r} \mathbf{3\frac{1}{4}} \\ \mathbf{2\frac{1}{4}} \\ \hline \mathbf{5\frac{2}{4} = 5\frac{1}{2}} \end{array}$$
>
> First add the fractions:
>
> $\frac{1}{4} + \frac{1}{4} = \frac{2}{4}$.
>
> Then add the whole numbers: $3 + 2 = 5$.
>
> Reduce $\frac{2}{4}$ to lowest terms:
>
> $5\frac{2}{4} = 5\frac{1}{2}$.
>
> Harry worked $5\frac{1}{2}$ hr. in his garden.

Study the following examples until you understand them. Then copy and work each example with your book closed.

$$\begin{array}{r} 2\frac{1}{3} \\ 4\frac{1}{3} \\ \hline 6\frac{2}{3} \end{array} \qquad \begin{array}{r} 3\frac{1}{8} \\ 7\frac{3}{8} \\ \hline 10\frac{4}{8} = 10\frac{1}{2} \end{array} \qquad \begin{array}{r} 8\frac{2}{5} \\ 7\frac{2}{5} \\ \hline 15\frac{4}{5} \end{array} \qquad \begin{array}{r} 7\frac{3}{10} \\ 9\frac{5}{10} \\ \hline 16\frac{8}{10} = 16\frac{4}{5} \end{array}$$

Find the sums of the following:

2. $\begin{array}{r} 4\frac{1}{8} \\ 5\frac{4}{8} \\ \hline \end{array}$ **5.** $\begin{array}{r} 6\frac{1}{4} \\ 4\frac{1}{4} \\ \hline \end{array}$ **8.** $\begin{array}{r} 7\frac{3}{5} \\ 9\frac{1}{5} \\ \hline \end{array}$ **11.** $\begin{array}{r} 6\frac{3}{8} \\ 7\frac{1}{8} \\ \hline \end{array}$ **14.** $\begin{array}{r} 5\frac{3}{6} \\ 6\frac{1}{6} \\ \hline \end{array}$

3. $\begin{array}{r} 7\frac{2}{5} \\ 6\frac{2}{5} \\ \hline \end{array}$ **6.** $\begin{array}{r} 5\frac{3}{8} \\ 3\frac{3}{8} \\ \hline \end{array}$ **9.** $\begin{array}{r} 15\frac{5}{12} \\ 18\frac{5}{12} \\ \hline \end{array}$ **12.** $\begin{array}{r} 24\frac{3}{16} \\ 7\frac{3}{16} \\ \hline \end{array}$ **15.** $\begin{array}{r} 4\frac{3}{10} \\ 33\frac{4}{10} \\ \hline \end{array}$

4. $\begin{array}{r} 4\frac{1}{4} \\ 5\frac{1}{4} \\ 7\frac{1}{4} \\ \hline \end{array}$ **7.** $\begin{array}{r} 5\frac{1}{8} \\ 6\frac{3}{8} \\ \frac{3}{8} \\ \hline \end{array}$ **10.** $\begin{array}{r} 9\frac{1}{6} \\ 8\frac{2}{6} \\ 5\frac{1}{6} \\ \hline \end{array}$ **13.** $\begin{array}{r} 5\frac{5}{16} \\ \frac{5}{16} \\ 7 \\ \hline \end{array}$ **16.** $\begin{array}{r} \frac{5}{12} \\ \frac{1}{12} \\ 7\frac{2}{12} \\ \hline \end{array}$

17. John caught three fish. One weighed $\frac{5}{8}$ pound, another weighed $1\frac{1}{8}$ pounds, and the third weighed 2 pounds. What was the total weight of the three fish?

LIBRARY PROBLEMS

Miss Jackson, principal of the Calhoun School, wishes to know what fraction of the children in the school have library cards. Here is a list of the grades the number of children enrolled, and the number of children in each class who have library cards.

Grade	Number of Children Enrolled	Number of Children With Library Cards	Fraction of Class Having Cards
3B	40	10	$\frac{1}{4}$
3A	40	15	?
4B	36	18	?
4A	42	28	?
5B	36	24	?
5A	32	28	?
6B	30	25	?
6A	35	28	?

1. In grade 3B, 10 out of 40 children have library cards; that is, $\frac{10}{40}$ (ten-fortieths) of the class have library cards. To what simpler form can $\frac{10}{40}$ be reduced?

2. What fraction of the children in grade 3A have library cards?

3. What fraction of the children in grade 4B have library cards?

4. What fraction of grade 4A have library cards? of 5B? of 5A? of 6B? of 6A?

5. What fraction of the children in your class have library cards?

6. How many children are there in grades 3B to 6A in Miss Jackson's school?

7. The library charges a fine of 3¢ a day for every day that a book is kept over two weeks. Mary kept a book 18 days. What fine must she pay?

ADDING MORE DIFFICULT MIXED NUMBERS

1. Mary worked for Mrs. Smith $2\frac{3}{4}$ hours on Friday and $5\frac{3}{4}$ hours on Saturday. How many hours did she work?

$\begin{array}{l} 2\frac{3}{4} \\ 5\frac{3}{4} \\ \hline 7\frac{6}{4} = 7 + 1\frac{1}{2} = 8\frac{1}{2} \end{array}$	Think: $2\frac{3}{4}$ hr. + $5\frac{3}{4}$ hr. = ? hr. First add the fractions. Then add the integers. The sum is $7\frac{6}{4}$, which must be reduced to simplest form: $\frac{6}{4} = 1\frac{2}{4} = 1\frac{1}{2}$ Mary worked $8\frac{1}{2}$ hr. for Mrs. Smith.

Study the following examples until you understand how to find the sums. Then copy the examples, close your book, and find the sums.

$$\begin{array}{l} 4\frac{5}{6} \\ 3\frac{4}{6} \\ \hline 7\frac{9}{6} = 7 + 1\frac{3}{6} = 8\frac{1}{2} \end{array} \qquad \begin{array}{l} 7\frac{2}{3} \\ 4\frac{2}{3} \\ \hline 11\frac{4}{3} = 11 + 1\frac{1}{3} = 12\frac{1}{3} \end{array} \qquad \begin{array}{l} 4\frac{1}{4} \\ 6\frac{3}{4} \\ \hline 10\frac{4}{4} = 11 \end{array}$$

Find the sums of the following:

2. $\begin{array}{r} 3\frac{3}{8} \\ 4\frac{7}{8} \\ \hline \end{array}$	**6.** $\begin{array}{r} 7\frac{3}{5} \\ 6\frac{4}{5} \\ \hline \end{array}$	**10.** $\begin{array}{r} 5\frac{1}{3} \\ 8\frac{2}{3} \\ \hline \end{array}$	**14.** $\begin{array}{r} 6\frac{5}{9} \\ 2\frac{7}{9} \\ \hline \end{array}$	**18.** $\begin{array}{r} 8\frac{5}{12} \\ 6\frac{11}{12} \\ \hline \end{array}$
3. $\begin{array}{r} 4\frac{3}{4} \\ 5\frac{3}{4} \\ 1\frac{1}{4} \\ \hline \end{array}$	**7.** $\begin{array}{r} 6\frac{2}{3} \\ \frac{2}{3} \\ 4\frac{2}{3} \\ \hline \end{array}$	**11.** $\begin{array}{r} 5\frac{3}{10} \\ 6\frac{7}{10} \\ \frac{9}{10} \\ \hline \end{array}$	**15.** $\begin{array}{r} 3\frac{7}{8} \\ 1\frac{7}{8} \\ 2\frac{5}{8} \\ \hline \end{array}$	**19.** $\begin{array}{r} 15\frac{1}{2} \\ \frac{1}{2} \\ \frac{1}{2} \\ \hline \end{array}$
4. $\begin{array}{r} \frac{3}{4} \\ \frac{3}{4} \\ \frac{1}{4} \\ \hline \end{array}$	**8.** $\begin{array}{r} 5\frac{1}{8} \\ 2\frac{3}{8} \\ 2\frac{3}{8} \\ \hline \end{array}$	**12.** $\begin{array}{r} 2\frac{4}{5} \\ 3\frac{3}{5} \\ 2\frac{2}{5} \\ \hline \end{array}$	**16.** $\begin{array}{r} 4\frac{1}{8} \\ \frac{3}{8} \\ 2\frac{2}{8} \\ \hline \end{array}$	**20.** $\begin{array}{r} 4\frac{1}{6} \\ 2\frac{5}{6} \\ 7 \\ \hline \end{array}$
5. $\begin{array}{r} \frac{4}{5} \\ \frac{4}{5} \\ \frac{3}{5} \\ \hline \end{array}$	**9.** $\begin{array}{r} 3\frac{5}{8} \\ 4\frac{7}{8} \\ 6\frac{4}{8} \\ \hline \end{array}$	**13.** $\begin{array}{r} 5\frac{3}{10} \\ \frac{1}{10} \\ \frac{3}{10} \\ \hline \end{array}$	**17.** $\begin{array}{r} 4\frac{2}{3} \\ 5\frac{2}{3} \\ \frac{2}{3} \\ \hline \end{array}$	**21.** $\begin{array}{r} 1\frac{1}{16} \\ 3\frac{5}{16} \\ 8\frac{4}{16} \\ \hline \end{array}$

SPECIAL PRACTICE IN REDUCTION

Reduce these fractions to their simplest form.

1.	$\frac{2}{4}, \frac{4}{8}, \frac{6}{8}$	**5.**	$\frac{2}{8}, \frac{3}{6}, \frac{6}{12}$	**9.**	$\frac{2}{6}, \frac{4}{6}, \frac{2}{12}$
2.	$\frac{3}{12}, \frac{4}{10}, \frac{2}{10}$	**6.**	$\frac{8}{12}, \frac{10}{12}, \frac{25}{10}$	**10.**	$\frac{9}{12}, \frac{6}{10}, \frac{14}{12}$
3.	$\frac{3}{15}, \frac{8}{10}, \frac{25}{15}$	**7.**	$\frac{4}{20}, \frac{36}{15}, \frac{5}{20}$	**11.**	$\frac{4}{24}, \frac{28}{20}, \frac{2}{24}$
4.	$\frac{6}{20}, \frac{12}{15}, \frac{10}{20}$	**8.**	$\frac{10}{15}, \frac{2}{20}, \frac{36}{24}$	**12.**	$\frac{9}{15}, \frac{3}{24}, \frac{38}{24}$

Some of the following fractions are in lowest terms. Name these fractions. Reduce the other fractions to lowest terms. Do not use a pencil.

13.	$\frac{4}{6}, \frac{2}{9}, \frac{8}{10}$	**17.**	$\frac{24}{15}, \frac{7}{28}, \frac{9}{12}$	**21.**	$\frac{4}{18}, \frac{14}{21}, \frac{16}{24}$
14.	$\frac{4}{7}, \frac{12}{8}, \frac{3}{15}$	**18.**	$\frac{22}{20}, \frac{12}{15}, \frac{2}{22}$	**22.**	$\frac{12}{18}, \frac{15}{25}, \frac{27}{36}$
15.	$\frac{12}{21}, \frac{7}{14}, \frac{9}{11}$	**19.**	$\frac{3}{14}, \frac{4}{15}, \frac{8}{36}$	**23.**	$\frac{28}{42}, \frac{16}{20}, \frac{10}{21}$
16.	$\frac{9}{15}, \frac{38}{10}, \frac{9}{14}$	**20.**	$\frac{9}{18}, \frac{24}{30}, \frac{15}{20}$	**24.**	$\frac{19}{24}, \frac{17}{35}, \frac{16}{27}$

25. Write 10 fractions not reduced to lowest terms.

Many children have difficulty in reducing numbers like $7\frac{6}{4}$ to the simplest form. Practice reducing the following:

26.	$7\frac{10}{8}$	**29.**	$8\frac{6}{4}$	**32.**	$7\frac{3}{2}$	**35.**	$6\frac{7}{5}$	**38.**	$5\frac{4}{3}$
27.	$7\frac{5}{2}$	**30.**	$9\frac{6}{3}$	**33.**	$8\frac{4}{2}$	**36.**	$9\frac{10}{5}$	**39.**	$6\frac{7}{3}$
28.	$12\frac{10}{2}$	**31.**	$9\frac{11}{4}$	**34.**	$14\frac{16}{8}$	**37.**	$17\frac{11}{10}$	**40.**	$18\frac{9}{6}$

TEST EXERCISE IN ADDING LIKE FRACTIONS

Practice on this exercise until you can work all of the examples correctly in less than 4 minutes.

1.	$\begin{array}{r}\frac{1}{3}\\ \underline{\frac{1}{3}}\end{array}$	**4.**	$\begin{array}{r}\frac{3}{8}\\ \underline{\frac{1}{8}}\end{array}$	**7.**	$\begin{array}{r}\frac{1}{4}\\ \underline{\frac{3}{4}}\end{array}$	**10.**	$\begin{array}{r}\frac{4}{5}\\ \underline{\frac{2}{5}}\end{array}$	**13.**	$\begin{array}{r}\frac{3}{4}\\ \underline{\frac{3}{4}}\end{array}$
2.	$\begin{array}{r}3\frac{1}{5}\\ \underline{2\frac{1}{5}}\end{array}$	**5.**	$\begin{array}{r}7\frac{1}{4}\\ \underline{2\frac{1}{4}}\end{array}$	**8.**	$\begin{array}{r}2\frac{1}{3}\\ \underline{7\frac{2}{3}}\end{array}$	**11.**	$\begin{array}{r}3\frac{3}{5}\\ \underline{2\frac{4}{5}}\end{array}$	**14.**	$\begin{array}{r}5\frac{5}{6}\\ \underline{2\frac{5}{6}}\end{array}$
3.	$\begin{array}{r}5\\ \underline{\frac{1}{4}}\end{array}$	**6.**	$\begin{array}{r}\frac{2}{3}\\ \underline{7}\end{array}$	**9.**	$\begin{array}{r}4\\ \underline{1\frac{2}{3}}\end{array}$	**12.**	$\begin{array}{r}3\frac{1}{2}\\ \underline{8}\end{array}$	**15.**	$\begin{array}{r}\frac{7}{10}\\ \underline{\frac{9}{10}}\end{array}$

SUBTRACTING EASY FRACTIONS

Margaret had $\frac{7}{8}$ yard of cloth. She cut off a piece $\frac{3}{8}$ yard long. How long was the piece of cloth that was left?

7 eighths minus 3 eighths is 4 eighths, just as 7 cents minus 3 cents is 4 cents.

$$\frac{7}{8} - \frac{3}{8} = \frac{4}{8} = \frac{1}{2}$$

There are four kinds of subtraction examples with like fractions. Study these examples carefully.

a	*b*	*c*	*d*
$\begin{array}{l}\frac{3}{4}\\ \frac{1}{4}\\ \hline \frac{2}{4} = \frac{1}{2}\end{array}$	$\begin{array}{l}\frac{5}{6}\\ \frac{4}{6}\\ \hline \frac{1}{6}\end{array}$	$\begin{array}{l}\frac{1}{2}\\ \frac{1}{2}\\ \hline \frac{0}{2} = 0\end{array}$	$\begin{array}{l}\frac{5}{8}\\ \frac{5}{8}\\ \hline \frac{0}{8} = 0\end{array}$

Any fraction with 0 as the numerator is equal to 0.

Copy the examples and work them with your book closed.

Practice with these sets of fractions until you can give the remainders rapidly and without mistakes.

Set I

	a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*
1.	$\begin{array}{c}\frac{3}{4}\\ \frac{2}{4}\\ \hline\end{array}$	$\begin{array}{c}\frac{4}{5}\\ \frac{1}{5}\\ \hline\end{array}$	$\begin{array}{c}\frac{3}{3}\\ \frac{1}{3}\\ \hline\end{array}$	$\begin{array}{c}\frac{5}{8}\\ \frac{4}{8}\\ \hline\end{array}$	$\begin{array}{c}\frac{7}{8}\\ \frac{2}{8}\\ \hline\end{array}$	$\begin{array}{c}\frac{6}{8}\\ \frac{3}{8}\\ \hline\end{array}$	$\begin{array}{c}\frac{5}{6}\\ \frac{4}{6}\\ \hline\end{array}$	$\begin{array}{c}\frac{7}{10}\\ \frac{6}{10}\\ \hline\end{array}$	$\begin{array}{c}\frac{3}{4}\\ \frac{1}{4}\\ \hline\end{array}$	$\begin{array}{c}\frac{5}{6}\\ \frac{2}{6}\\ \hline\end{array}$
2.	$\begin{array}{c}\frac{7}{8}\\ \frac{3}{8}\\ \hline\end{array}$	$\begin{array}{c}\frac{5}{10}\\ \frac{3}{10}\\ \hline\end{array}$	$\begin{array}{c}\frac{5}{6}\\ \frac{1}{6}\\ \hline\end{array}$	$\begin{array}{c}\frac{5}{8}\\ \frac{3}{8}\\ \hline\end{array}$	$\begin{array}{c}\frac{7}{12}\\ \frac{1}{12}\\ \hline\end{array}$	$\begin{array}{c}\frac{8}{10}\\ \frac{3}{10}\\ \hline\end{array}$	$\begin{array}{c}\frac{1}{4}\\ \frac{1}{4}\\ \hline\end{array}$	$\begin{array}{c}\frac{3}{5}\\ \frac{1}{5}\\ \hline\end{array}$	$\begin{array}{c}\frac{5}{9}\\ \frac{3}{9}\\ \hline\end{array}$	$\begin{array}{c}\frac{7}{8}\\ \frac{1}{8}\\ \hline\end{array}$

Set II

1.	$\begin{array}{c}\frac{1}{8}\\ \frac{1}{8}\\ \hline\end{array}$	$\begin{array}{c}\frac{7}{10}\\ \frac{2}{10}\\ \hline\end{array}$	$\begin{array}{c}\frac{9}{12}\\ \frac{1}{12}\\ \hline\end{array}$	$\begin{array}{c}\frac{6}{7}\\ \frac{4}{7}\\ \hline\end{array}$	$\begin{array}{c}\frac{7}{8}\\ \frac{1}{8}\\ \hline\end{array}$	$\begin{array}{c}\frac{6}{8}\\ \frac{3}{8}\\ \hline\end{array}$	$\begin{array}{c}\frac{1}{3}\\ \frac{1}{3}\\ \hline\end{array}$	$\begin{array}{c}\frac{5}{6}\\ \frac{1}{6}\\ \hline\end{array}$	$\begin{array}{c}\frac{9}{10}\\ \frac{2}{10}\\ \hline\end{array}$	$\begin{array}{c}\frac{2}{5}\\ \frac{2}{5}\\ \hline\end{array}$
2.	$\begin{array}{c}\frac{4}{20}\\ \frac{3}{20}\\ \hline\end{array}$	$\begin{array}{c}\frac{11}{15}\\ \frac{8}{15}\\ \hline\end{array}$	$\begin{array}{c}\frac{7}{8}\\ \frac{3}{8}\\ \hline\end{array}$	$\begin{array}{c}\frac{1}{9}\\ \frac{1}{9}\\ \hline\end{array}$	$\begin{array}{c}\frac{9}{6}\\ \frac{5}{6}\\ \hline\end{array}$	$\begin{array}{c}\frac{12}{9}\\ \frac{5}{9}\\ \hline\end{array}$	$\begin{array}{c}\frac{9}{8}\\ \frac{7}{8}\\ \hline\end{array}$	$\begin{array}{c}\frac{5}{4}\\ \frac{3}{4}\\ \hline\end{array}$	$\begin{array}{c}\frac{4}{3}\\ \frac{2}{3}\\ \hline\end{array}$	$\begin{array}{c}\frac{8}{5}\\ \frac{4}{5}\\ \hline\end{array}$

SUBTRACTING MIXED NUMBERS

1. A butcher cut a steak weighing $1\frac{1}{4}$ pounds from a piece of meat weighing $12\frac{3}{4}$ pounds. How much did the meat that was left weigh?

$\begin{array}{r} 12\frac{3}{4} \\ 1\frac{1}{4} \\ \hline 11\frac{2}{4} \end{array} = 11\frac{1}{2}$	Think: $12\frac{3}{4}$ lb. $-$ $1\frac{1}{4}$ lb. = ? lb. First subtract the fractions: $\frac{3}{4} - \frac{1}{4} = \frac{2}{4}$. Then subtract the integers: $12 - 1 = 11$. The total number of pounds left was $11\frac{1}{2}$ lb.

Study the following examples carefully:

$$\begin{array}{r} 9\frac{5}{6} \\ 2\frac{4}{6} \\ \hline 7\frac{1}{6} \end{array} \qquad \begin{array}{r} 8\frac{1}{8} \\ 7\frac{1}{8} \\ \hline 1 \end{array} \qquad \begin{array}{r} 8\frac{3}{4} \\ 8\frac{1}{4} \\ \hline \frac{2}{4} \end{array} = \frac{1}{2} \qquad \begin{array}{r} 9\frac{1}{4} \\ 9\frac{1}{4} \\ \hline 0 \end{array}$$

Copy these four examples on your paper and work them with your book closed.

Find the differences:

2. $4\frac{3}{4} - 2\frac{1}{4} =$	**5.** $5\frac{5}{8} - 4\frac{1}{8} =$	**8.** $14\frac{4}{5} - 4\frac{3}{5} =$
3. $9\frac{5}{6} - 1\frac{1}{6} =$	**6.** $10\frac{7}{9} - 5\frac{4}{9} =$	**9.** $12\frac{2}{3} - 10\frac{1}{3} =$
4. $7\frac{3}{8} - 4\frac{1}{8} =$	**7.** $11\frac{7}{8} - 5\frac{7}{8} =$	**10.** $18\frac{5}{9} - 14\frac{2}{9} =$

11. Mary was $57\frac{3}{4}$ inches tall, and Julia was $54\frac{1}{4}$ inches tall. How much taller than Julia was Mary?

12. One roast weighed $7\frac{7}{8}$ pounds and another weighed $5\frac{3}{8}$ pounds. How much less than the first did the second weigh?

13. One Saturday Alice worked in her garden $3\frac{1}{2}$ hours in the morning and $1\frac{1}{2}$ hours in the afternoon. How long did she work in all?

14. One day she sold 15 bunches of sweet peas at 25 cents a bunch. What did she receive for the flowers?

SUBTRACTING FRACTIONS AND WHOLE NUMBERS

1. Draw a line 2 inches long. Erase $\frac{1}{2}$ inch. How long is the remaining part of the line?

2 in. − $\frac{1}{2}$ in. = ? $\begin{array}{rcr} 2 & = & 1\frac{2}{2} \\ \frac{1}{2} & = & \frac{1}{2} \\ \hline & & 1\frac{1}{2} \end{array}$	By measuring with a ruler you can show that the remaining length is $1\frac{1}{2}$ in. An easier way to find the answer is: Think: before $\frac{1}{2}$ can be subtracted from 2, 2 must be changed to $1\frac{2}{2}$. The example then becomes $1\frac{2}{2} - \frac{1}{2} = 1\frac{1}{2}$.

2. Draw a line 4 inches long. Erase $2\frac{1}{2}$ inches. How much is left?

Practice these examples:

	a	*b*	*c*
3.	$5 = 4\frac{}{2}$	$5 = 4\frac{}{4}$	$11 = 10\frac{}{8}$
4.	$3 = 2\frac{}{3}$	$7 = 6\frac{}{6}$	$14 = 13\frac{}{10}$
5.	$8 = 7\frac{}{4}$	$8 = 7\frac{}{9}$	$10 = 9\frac{}{12}$
6.	$9 = 8\frac{}{5}$	$3 = 2\frac{}{2}$	$14 = 13\frac{}{16}$

7. A dressmaker cut $2\frac{1}{4}$ yards from a piece of cloth 5 yards long. How much was left?

8. A cook bought 2 pounds of butter and used $\frac{3}{4}$ pound for a cake. How much butter was left?

Give the remainders quickly:

	a	*b*	*c*
9.	$1 - \frac{1}{8} =$	$6 - \frac{3}{8} =$	$7 - 1\frac{1}{2} =$
10.	$1 - \frac{1}{4} =$	$7 - \frac{5}{7} =$	$8 - 1\frac{5}{8} =$
11.	$2 - \frac{1}{2} =$	$4 - \frac{3}{4} =$	$6 - 3\frac{7}{10} =$
12.	$3 - \frac{1}{5} =$	$6 - \frac{2}{3} =$	$8 - 2\frac{5}{9} =$
13.	$4 - \frac{3}{5} =$	$7 - \frac{1}{4} =$	$9 - 8\frac{7}{8} =$

FINDING DIFFERENCES IN LENGTH

1. How much less than a yard is each of the following lengths of cloth: $\frac{1}{2}$ yd.? $\frac{1}{4}$ yd.? $\frac{1}{8}$ yd.? $\frac{3}{4}$ yd.? $\frac{5}{8}$ yd.? $\frac{7}{8}$ yd.? $\frac{3}{8}$ yd.? $\frac{5}{6}$ yd.? $\frac{1}{3}$ yd.? $\frac{1}{6}$ yd.? $\frac{2}{3}$ yd.? $\frac{3}{5}$ yd.?

2. How much less than 2 yards in each of these lengths: $\frac{1}{2}$ yd.? $\frac{3}{4}$ yd.? $1\frac{1}{2}$ yd.? $1\frac{1}{4}$ yd.? $1\frac{3}{4}$ yd.? $1\frac{1}{8}$ yd.? $\frac{7}{8}$ yd.?

3. In a certain state all black bass less than 8 inches in length must be thrown back into the lake. The numbers below give the lengths of some bass which were caught. Which of these fish must be thrown back? How much too short is each?

$6\frac{7}{8}$ in.	$7\frac{1}{4}$ in.	$8\frac{3}{8}$ in.	$9\frac{1}{8}$ in.
$5\frac{1}{2}$ in.	$6\frac{3}{4}$ in.	$5\frac{5}{8}$ in.	$6\frac{1}{4}$ in.

4. The average height for children 11 years of age is about 58 inches. Are these eleven-year-old children taller or shorter than the average? how much?

Charles . . . $59\frac{1}{4}$ in.	Kate . . . $60\frac{3}{4}$ in.	John . . . $58\frac{3}{8}$ in.
Mary . . . . . $56\frac{1}{8}$ in.	Carl . . . . $57\frac{1}{4}$ in.	Julia . . . $59\frac{7}{8}$ in.

Here is part of the record Jack and Helen kept of the lengths of the shadows made by their shadow stick.

at 9:00 o'clock—$18\frac{1}{4}$ in.	at 12:00 o'clock—3 in.
at 10:00 o'clock—$12\frac{3}{4}$ in.	at 1:00 o'clock—$6\frac{1}{4}$ in.
at 11:00 o'clock— $7\frac{1}{4}$ in.	at 2:00 o'clock—12 in.

5. When was the shadow longest? shortest?

6. How much shorter than at 9 o'clock was the shadow at 11 o'clock?

7. How much longer than at 1 o'clock was the shadow at 2 o'clock?

8. How much longer than at 12 o'clock was the shadow at 10 o'clock?

A NEW STEP IN SUBTRACTING FRACTIONS

1. A milliner cut $4\frac{3}{4}$ yards of ribbon from a piece $7\frac{1}{4}$ yards long. How much ribbon was left?

$7\frac{1}{4} - 4\frac{3}{4}$ yd. $= ?$	Think: $\frac{3}{4}$ cannot be subtracted from $\frac{1}{4}$.
$7\frac{1}{4} = 6\frac{5}{4}$	$7 = 6\frac{4}{4}$. $7\frac{1}{4} = 6\frac{5}{4}$
$-4\frac{3}{4} = 4\frac{3}{4}$	Subtract the fractions: $\frac{5}{4} - \frac{3}{4} = \frac{2}{4} = \frac{1}{2}$.
	Subtract 4 from 6.
$2\frac{2}{4} = 2\frac{1}{2}$	$2\frac{1}{2}$ yards were left.

	a	*b*	*c*	*d*
2.	$1\frac{1}{4} - \frac{3}{4} =$	$1\frac{1}{5} - \frac{3}{5} =$	$1\frac{1}{6} - \frac{5}{6} =$	$1\frac{1}{16} - \frac{13}{16} =$
3.	$1\frac{1}{3} - \frac{2}{3} =$	$1\frac{3}{8} - \frac{7}{8} =$	$1\frac{2}{9} - \frac{5}{9} =$	$1\frac{5}{12} - \frac{7}{12} =$
4.	$1\frac{5}{8} - \frac{7}{8} =$	$1\frac{1}{10} - \frac{6}{10} =$	$1\frac{1}{8} - \frac{3}{8} =$	$1\frac{7}{20} - \frac{9}{20} =$

Practice with these examples. They will help you to change mixed numbers to the form used in problem **1**.

	a	*b*	*c*
5.	$7\frac{1}{4} = 6\frac{?}{4}$	$9\frac{1}{8} = 8\frac{?}{8}$	$5\frac{4}{9} = 4\frac{?}{9}$
6.	$8\frac{1}{3} = 7\frac{?}{3}$	$7\frac{1}{10} = 6\frac{?}{10}$	$18\frac{3}{5} = 17\frac{?}{5}$
7.	$9\frac{1}{2} = 8\frac{?}{2}$	$5\frac{2}{5} = 4\frac{?}{5}$	$9\frac{5}{16} = 8\frac{?}{16}$
8.	$5\frac{1}{6} = 4\frac{?}{6}$	$8\frac{3}{8} = 7\frac{?}{8}$	$10\frac{7}{24} = 9\frac{?}{24}$

9. One piece of meat weighed $7\frac{1}{4}$ pounds. Another weighed $1\frac{3}{4}$ pounds. How much more than the second did the first piece weigh?

10. John had two boards. One was $12\frac{3}{8}$ feet long and the other $9\frac{7}{8}$ feet long. Find the difference in their lengths.

Find the differences in the examples below.

	a	*b*	*c*
11.	$8\frac{1}{4} - 4\frac{3}{4} =$	$8\frac{1}{5} - 4\frac{3}{5} =$	$5\frac{1}{12} - 3\frac{11}{12} =$
12.	$5\frac{1}{3} - 2\frac{2}{3} =$	$5\frac{3}{6} - 2\frac{5}{6} =$	$6\frac{5}{12} - 5\frac{7}{12} =$
13.	$6\frac{3}{8} - 1\frac{5}{8} =$	$8\frac{5}{9} - 3\frac{7}{9} =$	$8\frac{7}{16} - 7\frac{9}{16} =$

TIMING RACES WITH A STOP WATCH

Harry's brother used a stop watch like the one in the picture to time the races at the school field day.

1. The second hand on the watch is always at 60 when the watch is started. Count on the watch by fifths to 5, saying $\frac{1}{5}$, $\frac{2}{5}$, $\frac{3}{5}$, and so on. Remember $\frac{5}{5}$ is 1.

2. The pupils had many foot races. James won the first of the boys' 50-yard dashes. He ran the 50 yards in the number of seconds shown by the second hand in the picture. How many seconds is this? How much less than 11 seconds is this?

3. Mary won the 50-yard dash for girls. She ran it in $10\frac{4}{5}$ seconds. How much longer than it took James did it take Mary to run 50 yards?

4. The older boys had 100-yard races. Harry won one of these. His time was $14\frac{3}{5}$ seconds. How much less than 15 seconds is this?

5. The older girls thought that they would also like to run the 100 yards. Martha won. Her time was $16\frac{1}{5}$ seconds. How much slower than Harry was Martha?

6. There were six relay races for the younger boys. There were three boys in each team. Each boy ran 50 yards. Fred, Will, and Jack won the first race. Fred ran his 50 yards in $10\frac{2}{5}$ seconds, Will ran his in $11\frac{1}{5}$ seconds, and Jack his in $9\frac{2}{5}$ seconds. In how many seconds was this relay race run? How much less than a minute is this?

7. The following is the time for each boy in the winning teams for three of the relays. Find the time for each of the relays. Whose team ran the race in the shortest time?

	Frank's Team	Harry's Team	George's Team
Boy No. 1	$10\frac{1}{5}$ sec.	11 sec.	$9\frac{2}{5}$ sec.
Boy No. 2	$9\frac{3}{5}$ sec.	$10\frac{3}{5}$ sec.	$11\frac{4}{5}$ sec.
Boy No. 3	10 sec.	$9\frac{2}{5}$ sec.	$10\frac{4}{5}$ sec.

8. Which boy ran his 50 yards in the shortest time? How much shorter was this than the time of each of the other boys on his team?

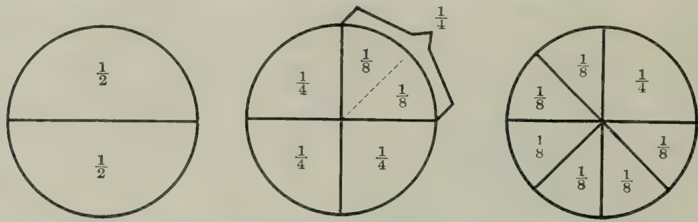
9. Which boy took the longest time to run his 50 yards? How much longer was this than the time of each of the other boys on his team?

TEST EXERCISE IN SUBTRACTING LIKE FRACTIONS

Practice this exercise until you can work all of the examples correctly in 8 minutes.

1. $\frac{2}{3}$ $\underline{\frac{1}{3}}$	**4.** $3\frac{1}{5}$ $\underline{1}$	**7.** $3\frac{4}{5}$ $\underline{2\frac{1}{5}}$	**10.** 9 $\underline{\frac{1}{4}}$	**13.** $8\frac{1}{6}$ $\underline{4\frac{5}{6}}$
2. $\frac{3}{4}$ $\underline{\frac{1}{4}}$	**5.** $3\frac{5}{6}$ $\underline{\frac{1}{6}}$	**8.** $5\frac{7}{8}$ $\underline{2\frac{1}{8}}$	**11.** 7 $\underline{2\frac{1}{2}}$	**14.** $7\frac{5}{8}$ $\underline{6\frac{7}{8}}$
3. $\frac{1}{5}$ $\underline{\frac{4}{5}}$	**6.** 1 $\underline{\frac{1}{6}}$	**9.** $8\frac{7}{8}$ $\underline{4\frac{1}{8}}$	**12.** $8\frac{1}{4}$ $\underline{5\frac{3}{4}}$	**15.** $8\frac{1}{9}$ $\underline{\frac{1}{9}}$

USING HALVES, FOURTHS, AND EIGHTHS



1. How many fourths are there in $\frac{1}{2}$? $\frac{1}{2} = \frac{?}{4}$.

2. How many eighths are there in $\frac{1}{2}$? $\frac{1}{2} = \frac{?}{8}$.

3. Use the three circles to find the missing numbers in the following:

$\frac{1}{4} = \frac{?}{8}$ $\frac{3}{4} = \frac{?}{8}$ $\frac{4}{8} = \frac{?}{4}$ $\frac{6}{8} = \frac{?}{4}$ $1 = \frac{?}{2}, \frac{?}{4}$

4. How many halves are there in a circle? how many fourths? how many eighths?

5. $\frac{1}{4}$ circle + $\frac{1}{4}$ circle = what part of a circle?

6. $\frac{1}{8}$ circle + $\frac{1}{8}$ circle = what part of a circle?

7. $\frac{3}{8}$ circle + $\frac{3}{8}$ circle = $\frac{?}{8} = \frac{?}{4}$

Use the circles to show that:

8. $\frac{1}{4} + \frac{1}{4} = \frac{1}{2}$	**13.** $\frac{1}{4} + \frac{3}{4} = 1$	**18.** $\frac{1}{4} + \frac{1}{8} + \frac{1}{8} = \frac{1}{2}$
9. $\frac{1}{8} + \frac{1}{8} = \frac{1}{4}$	**14.** $\frac{1}{2} + \frac{1}{2} = 1$	**19.** $\frac{3}{8} + \frac{1}{8} + \frac{1}{4} = \frac{3}{4}$
10. $\frac{3}{8} + \frac{1}{8} = \frac{1}{2}$	**15.** $\frac{1}{2} + \frac{4}{8} = 1$	**20.** $\frac{1}{2} + \frac{1}{4} + \frac{1}{8} = \frac{7}{8}$
11. $\frac{1}{4} + \frac{2}{8} = \frac{1}{2}$	**16.** $\frac{1}{4} + \frac{4}{8} = \frac{3}{4}$	**21.** $\frac{2}{8} + \frac{2}{8} + \frac{1}{4} = \frac{3}{4}$
12. $\frac{1}{4} + \frac{1}{2} = \frac{3}{4}$	**17.** $\frac{1}{8} + \frac{5}{8} = \frac{3}{4}$	**22.** $\frac{1}{4} + \frac{1}{4} + \frac{2}{8} = \frac{3}{4}$

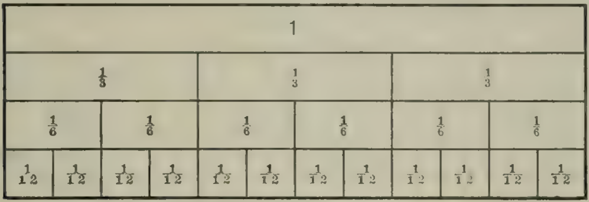
Learn these facts:

$\frac{1}{2} = \frac{2}{4}$ $\frac{1}{2} = \frac{4}{8}$ $\frac{1}{4} = \frac{2}{8}$ $\frac{3}{4} = \frac{6}{8}$

23. If you had $\frac{1}{2}$ pound of butter and bought $\frac{1}{2}$ pound more, how much would you then have?

24. If you had $\frac{3}{4}$ yard of cloth and bought $\frac{1}{4}$ yard more, would you have a whole yard of cloth?

CHANGING FRACTIONS TO HIGHER TERMS



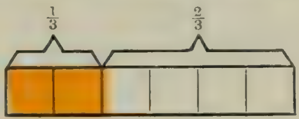
Study the drawing and prove that:

$\frac{1}{3} = \frac{2}{6}$ $\quad$ $\frac{1}{3} = \frac{4}{12}$ $\quad$ $\frac{2}{3} = \frac{4}{6}$ $\quad$ $\frac{2}{3} = \frac{8}{12}$

You see that $\frac{1}{3}$, $\frac{2}{6}$, and $\frac{4}{12}$ all have the same value but are written in different ways.

To change $\frac{1}{3}$ to $\frac{2}{6}$, multiply each term of the fraction by 2.

$$\frac{1}{3} = \frac{1 \times 2}{3 \times 2} = \frac{2}{6} \qquad \frac{2}{3} = \frac{2 \times 2}{3 \times 2} = \frac{4}{6}$$



To change $\frac{1}{3}$ to $\frac{4}{12}$, multiply each term of the fraction by 4. Why? Study the drawing and prove that $\frac{1}{3} = \frac{4}{12}$.

$$\frac{1}{3} = \frac{1 \times 4}{3 \times 4} = \frac{4}{12} \qquad \frac{2}{3} = \frac{2 \times 4}{3 \times 4} = \frac{8}{12}$$

This work shows that *when both terms of a fraction are multiplied by the same number, the value of the fraction is not changed.*

When both terms of a fraction are multiplied by the same number, the fraction is changed to *higher terms.*

1. How can $\frac{2}{3}$ be changed to $\frac{8}{12}$? to $\frac{6}{9}$? to $\frac{4}{6}$?

2. How can $\frac{1}{2}$ be changed to $\frac{4}{8}$? to $\frac{6}{12}$? to $\frac{8}{16}$?

3. Change to 16ths: $\frac{1}{8}$, $\frac{5}{8}$, $\frac{3}{8}$, $\frac{7}{8}$, $\frac{3}{4}$, $\frac{1}{4}$.

4. Change to 20ths: $\frac{1}{2}$, $\frac{1}{4}$, $\frac{3}{4}$, $\frac{4}{5}$, $\frac{1}{5}$, $\frac{9}{10}$.

PRACTICE IN CHANGING THE FORM OF FRACTIONS

Supply the missing numerators:

1. $\frac{1}{2} = \frac{\ }{4}$
2. $\frac{1}{3} = \frac{\ }{6}$
3. $\frac{1}{4} = \frac{\ }{8}$
4. $\frac{1}{5} = \frac{\ }{10}$
5. $\frac{1}{6} = \frac{\ }{12}$
6. $\frac{1}{2} = \frac{\ }{8}$
7. $\frac{1}{8} = \frac{\ }{16}$
8. $\frac{1}{3} = \frac{\ }{9}$
9. $\frac{1}{10} = \frac{\ }{20}$
10. $\frac{1}{4} = \frac{\ }{12}$
11. $\frac{1}{2} = \frac{\ }{6}$
12. $\frac{1}{12} = \frac{\ }{36}$
13. $\frac{1}{5} = \frac{\ }{25}$
14. $\frac{2}{3} = \frac{\ }{9}$
15. $\frac{3}{4} = \frac{\ }{8}$
16. $\frac{1}{2} = \frac{\ }{10}$
17. $\frac{2}{4} = \frac{\ }{12}$
18. $\frac{3}{5} = \frac{\ }{10}$
19. $\frac{1}{4} = \frac{\ }{16}$
20. $\frac{4}{7} = \frac{\ }{21}$
21. $\frac{1}{6} = \frac{\ }{18}$
22. $\frac{1}{3} = \frac{\ }{12}$
23. $\frac{2}{5} = \frac{\ }{20}$
24. $\frac{2}{3} = \frac{\ }{6}$
25. $\frac{1}{5} = \frac{\ }{15}$
26. $\frac{5}{6} = \frac{\ }{18}$
27. $\frac{3}{8} = \frac{\ }{32}$
28. $\frac{7}{8} = \frac{\ }{16}$
29. $\frac{7}{10} = \frac{\ }{40}$
30. $\frac{1}{8} = \frac{\ }{24}$
31. $\frac{2}{10} = \frac{\ }{30}$
32. $\frac{1}{2} = \frac{\ }{12}$
33. $\frac{4}{5} = \frac{\ }{30}$
34. $\frac{1}{4} = \frac{\ }{24}$
35. $\frac{11}{12} = \frac{\ }{36}$
36. $\frac{5}{8} = \frac{\ }{40}$

FINDING DIFFICULTIES IN WORKING WITH FRACTIONS

In working the examples below, be sure to reduce all answers to lowest terms.

Find the sums.

1.	2.	3.	4.	5.
$\frac{1}{2}$	$\frac{3}{4}$	$1\frac{1}{8}$	$2\frac{1}{6}$	$3\frac{1}{2}$
$\frac{1}{2}$	$\frac{1}{4}$	$2\frac{3}{8}$	$5\frac{1}{6}$	$2\frac{1}{2}$
$\frac{1}{2}$	$\frac{3}{4}$	$3\frac{7}{8}$	$\frac{1}{6}$	6

Find the differences.

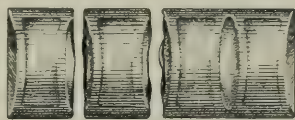
1.	3.	5.	7.	9.
$\frac{3}{4}$	$\frac{7}{8}$	$\frac{1}{5}$	$2\frac{3}{4}$	$5\frac{1}{2}$
$\frac{1}{4}$	$\frac{5}{8}$	$\frac{1}{5}$	$\frac{1}{4}$	$2\frac{1}{2}$

2.	4.	6.	8.	10.
1	4	$7\frac{1}{4}$	$9\frac{1}{8}$	$6\frac{5}{8}$
$\frac{7}{8}$	$1\frac{1}{4}$	$2\frac{3}{4}$	$8\frac{7}{8}$	$2\frac{7}{8}$

ADDING HALVES, FOURTHS, AND EIGHTHS

1. Tom divided an apple into fourths. He gave $\frac{1}{4}$ of the apple to Fred and $\frac{2}{4}$ to Willie. How many fourths did he give away?

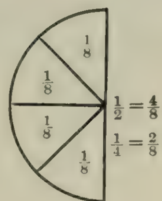
Think: $\frac{1}{4} + \frac{2}{4} = \frac{3}{4}$



2. Fred had a chocolate bar. He gave $\frac{1}{2}$ of it to Tom and $\frac{1}{4}$ to Jack. What part of his chocolate bar did he give away?

Think: $\frac{1}{2} + \frac{1}{4} = ?$

$\frac{2}{4} + \frac{1}{4} = \frac{3}{4}$.



In adding fractions always think: *Fractions cannot be added until they have the same denominator*.

3. $\frac{1}{2} + \frac{1}{8} = ?$ Change $\frac{1}{2}$ to $\frac{4}{8}$.

$\frac{4}{8} + \frac{1}{8} = \frac{5}{8}$

4. $\frac{1}{4} + \frac{1}{8} = ?$ Change $\frac{1}{4}$ to $\frac{2}{8}$.

$\frac{2}{8} + \frac{1}{8} = \frac{3}{8}$

In adding fourths and halves, change halves to fourths.
In adding halves and eighths, change halves to eighths.
In adding fourths and eighths, change fourths to eighths.

$\frac{1}{2} = \frac{2}{4}$	$\frac{1}{2} = \frac{?}{8}$	$\frac{1}{4} = \frac{?}{8}$ $\frac{3}{4} = \frac{?}{8}$
5. $\frac{1}{2} + \frac{3}{8} =$	**9.** $\frac{3}{4} + \frac{1}{8} =$	**13.** $\frac{1}{2} + \frac{1}{4} =$
6. $\frac{1}{4} + \frac{1}{2} =$	**10.** $\frac{3}{8} + \frac{1}{4} =$	**14.** $\frac{1}{2} + \frac{4}{8} =$
7. $\frac{1}{8} + \frac{1}{2} =$	**11.** $\frac{1}{4} + \frac{5}{8} =$	**15.** $\frac{3}{8} + \frac{1}{2} =$
8. $\frac{1}{8} + \frac{1}{4} =$	**12.** $\frac{1}{2} + \frac{3}{8} =$	**16.** $\frac{5}{8} + \frac{1}{4} =$

When fractions have the same denominator, we say that they have a *common denominator*.

USING A RULER TO CHECK WORK IN FRACTIONS

You can often use your ruler to check your work in adding and subtracting fractions.

1. The line below has two parts. How long is each part?

2. Measure the length of the whole line with your ruler. $1\frac{1}{4}$ in. + $1\frac{3}{4}$ in. = ? in.

3. Find the sum of $1\frac{1}{4}$ and $1\frac{3}{4}$ by addition.

$\begin{array}{r} 1\frac{1}{4} \\ 1\frac{3}{4} \\ \hline 3 \end{array}$	You can see that the sum of $1\frac{1}{4}$ and $1\frac{3}{4}$ is 3. The length of the line in problem **2** is 3 inches. This shows that your work in problems **2** and **3** checks.

4. Draw a line $1\frac{1}{2}$ inches long. Extend the line $2\frac{1}{2}$ inches. Measure the length of the whole line with a ruler.

5. Find the sum of $1\frac{1}{2}$ and $2\frac{1}{2}$. Does your work in problems **4** and **5** check?

Find the following sums and check as in problem **4**:

6. $2\frac{1}{4}$ in. + $4\frac{1}{4}$ in. =

7. $3\frac{1}{4}$ in. + $2\frac{3}{4}$ in. =

8. $2\frac{1}{2}$ in. + $1\frac{1}{2}$ in. =

9. $\frac{3}{4}$ in. + $2\frac{1}{4}$ in. =

10. $2\frac{1}{2}$ in. + $\frac{1}{2}$ in. =

11. $3\frac{1}{4}$ in. + $2\frac{1}{2}$ in. =

12. $2\frac{3}{4}$ in. + $3\frac{1}{2}$ in. =

13. $2\frac{1}{2}$ in. + $1\frac{1}{4}$ in. =

14. $\frac{3}{4}$ in. + $\frac{1}{4}$ in. =

15. $\frac{1}{2}$ in. + $\frac{3}{4}$ in. =

16. How much longer than a $3\frac{1}{2}$-inch line is a line $4\frac{3}{4}$ inches long?

17. Draw a line $2\frac{1}{2}$ inches long. Erase or cover with a paper $1\frac{1}{2}$ inches of it. How long is the part that is left? $2\frac{1}{2}$ in. − $1\frac{1}{2}$ in. = ? Check by subtraction.

Find the differences in the following by subtraction and check with a ruler.

18. $3\frac{1}{2}$ in. − 2 in. =

19. $3\frac{3}{4}$ in. − $1\frac{3}{4}$ in. =

20. $3\frac{1}{4}$ in. − $1\frac{3}{4}$ in. =

21. $3\frac{1}{2}$ in. − $1\frac{3}{4}$ in. =

ADDING THIRDS, SIXTHS, AND TWELFTHS

1. It was $\frac{1}{12}$ mile from Mary's home to the boat house on the lake and $\frac{1}{3}$ mile across the lake to the store. How far was it from Mary's home to the store?

$\frac{1}{12} = \frac{1}{12}$ $\frac{1}{3} = \frac{4}{12}$ $\frac{5}{12}$	Think: $\frac{1}{12}$ mi. + $\frac{1}{3}$ mi. = ? mi. Change $\frac{1}{3}$ to $\frac{4}{12}$ so that both fractions will have the same denominator. Then add.

Study the following examples. Show that the work is correct.

2.
$$\begin{array}{rcl} \frac{2}{3} &=& \frac{8}{12} \\ \frac{1}{12} &=& \frac{1}{12} \\ \hline && \frac{9}{12} = \frac{3}{4} \end{array}$$

3.
$$\begin{array}{rcl} \frac{1}{3} &=& \frac{2}{6} \\ \frac{1}{6} &=& \frac{1}{6} \\ \hline && \frac{3}{6} = \frac{1}{2} \end{array}$$

4.
$$\begin{array}{rcl} \frac{1}{6} &=& \frac{2}{12} \\ \frac{11}{12} &=& \frac{11}{12} \\ \hline && \frac{13}{12} = 1\frac{1}{12} \end{array}$$

5. Copy examples **2** to **4** and work them with your book closed. Remember that fractions cannot be added unless they have like denominators.

Find the sums of the following:

6. $\frac{2}{3}$ $\frac{1}{6}$	**9.** $\frac{1}{12}$ $\frac{5}{6}$	**12.** $\frac{7}{12}$ $\frac{1}{3}$	**15.** $\frac{1}{2}$ $\frac{7}{8}$	**18.** $\frac{1}{4}$ $\frac{3}{8}$
7. $\frac{1}{3}$ $\frac{1}{12}$	**10.** $\frac{5}{6}$ $\frac{7}{12}$	**13.** $\frac{5}{6}$ $\frac{11}{12}$	**16** $\frac{1}{6}$ $\frac{1}{12}$	**19.** $\frac{2}{3}$ $\frac{5}{12}$
8. $\frac{1}{3}$ $\frac{5}{12}$ $\frac{1}{6}$	**11** $\frac{2}{3}$ $\frac{11}{12}$ $\frac{11}{12}$	**14.** $\frac{5}{6}$ $\frac{2}{3}$ $\frac{1}{3}$	**17.** $\frac{5}{12}$ $\frac{2}{3}$ $\frac{5}{6}$	**20** $\frac{5}{8}$ $\frac{1}{4}$ $\frac{3}{4}$

21. *In adding thirds and twelfths, change thirds to ——.*

22. *In adding thirds and sixths, change thirds to ——.*

23. *In adding sixths and twelfths, change sixths to ——.*

FINDING MORE DIFFICULT COMMON DENOMINATORS

Sometimes it is not easy to find a common denominator of two or more fractions.

$\frac{1}{4} = \frac{3}{12}$ $\frac{2}{3} = \frac{8}{12}$ $\overline{\frac{11}{12}}$	For example, $\frac{1}{4} + \frac{2}{3} = ?$ See the denominators 4 and 3. Think: What number will contain 4 and 3 without a remainder? 12 is that number. To find 12, multiply 4 and 3. $4 \times 3 = 12$. Change $\frac{1}{4}$ and $\frac{2}{3}$ to twelfths.

Study the following examples until you understand how the denominators were found.

1.
$$\begin{aligned} \tfrac{1}{2} &= \tfrac{3}{6} \\ \tfrac{1}{3} &= \tfrac{2}{6} \\ \tfrac{1}{6} &= \tfrac{1}{6} \\ \hline & \tfrac{6}{6} = 1 \end{aligned}$$

2.
$$\begin{aligned} \tfrac{1}{4} &= \tfrac{4}{16} \\ \tfrac{1}{8} &= \tfrac{2}{16} \\ \tfrac{1}{16} &= \tfrac{1}{16} \\ \hline & \tfrac{7}{16} \end{aligned}$$

3.
$$\begin{aligned} \tfrac{1}{4} &= \tfrac{6}{24} \\ \tfrac{5}{6} &= \tfrac{20}{24} \\ \tfrac{3}{8} &= \tfrac{9}{24} \\ \hline & \tfrac{35}{24} = 1\tfrac{11}{24} \end{aligned}$$

Copy the examples, then work them with the book closed.

4. What is the smallest number that will contain each of the following groups?

6, 8	3, 8	2, 5, 10	3, 4, 5	4, 10
4, 6	2, 3	2, 3, 4	3, 5, 6	6, 9
2, 5	4, 10	4, 8, 12	3, 4, 12	4, 6, 8

5. In adding $\frac{1}{3}$ and $\frac{1}{2}$, change $\frac{1}{3}$ to —— and $\frac{1}{2}$ to ——.

6. In adding $\frac{1}{3}$ and $\frac{1}{4}$, change $\frac{1}{3}$ to —— and $\frac{1}{4}$ to ——.

7. In adding $\frac{1}{4}$ and $\frac{1}{5}$, change $\frac{1}{4}$ to —— and $\frac{1}{5}$ to ——.

8. In adding $\frac{1}{2}$ and $\frac{1}{5}$, change $\frac{1}{2}$ to —— and $\frac{1}{5}$ to ——.

9. In adding $\frac{1}{4}$ and $\frac{1}{6}$, change $\frac{1}{4}$ to —— and $\frac{1}{6}$ to ——.

10. In adding $\frac{3}{4}$ and $\frac{7}{10}$, change $\frac{3}{4}$ to —— and $\frac{7}{10}$ to ——.

11. In adding $\frac{2}{3}$ and $\frac{3}{5}$, change $\frac{2}{3}$ to —— and $\frac{3}{5}$ to ——.

12. In adding $\frac{7}{8}$ and $\frac{5}{6}$, change $\frac{7}{8}$ to —— and $\frac{5}{6}$ to ——.

13. In adding $\frac{4}{5}$ and $\frac{9}{10}$, change $\frac{4}{5}$ to ——.

14. In adding $\frac{5}{6}$ and $\frac{7}{9}$, change $\frac{5}{6}$ to —— and $\frac{7}{9}$ to ——.

AN EASY WAY TO FIND A COMMON DENOMINATOR

Here is an easy way to find a common denominator when adding fractions like $\frac{1}{2}$, $\frac{1}{4}$, and $\frac{1}{5}$.

$\frac{1}{2} = \frac{10}{20}$ $\frac{1}{4} = \frac{5}{20}$ $\frac{1}{5} = \frac{4}{20}$ $\overline{}$ $\frac{19}{20}$	Try 5 as a denominator. 5 will not contain 2 or 4. Try 2×5, or 10 as a denominator. 10 will contain 2 and 5, but not 4. Try 2×4, or 8 as a denominator. 8 will not contain 5. Try 4×5, or 20 as a denominator. 20 is correct, since it will contain all three denominators.

Find a common denominator for:

1. $\frac{1}{2}, \frac{1}{3}, \frac{1}{4}$ **2.** $\frac{1}{4}, \frac{1}{5}, \frac{1}{6}$ **3.** $\frac{1}{6}, \frac{1}{8}, \frac{1}{10}$. **4.** $\frac{1}{2}, \frac{1}{8}, \frac{1}{10}$.

Find the sums.

Set I

	a	*b*	*c*
1.	$\frac{1}{2} + \frac{1}{4} =$	$\frac{1}{3} + \frac{1}{5} =$	$\frac{2}{3} + \frac{1}{6} =$
2.	$\frac{1}{4} + \frac{1}{3} =$	$\frac{1}{2} + \frac{1}{5} =$	$\frac{3}{4} + \frac{1}{8} =$
3.	$\frac{1}{2} + \frac{1}{3} =$	$\frac{1}{4} + \frac{1}{5} =$	$\frac{3}{8} + \frac{1}{2} =$

Set II

4.	$\frac{1}{3} + \frac{3}{4} =$	$\frac{4}{5} + \frac{3}{10} =$	$\frac{7}{8} + \frac{3}{4} =$
5.	$\frac{4}{5} + \frac{1}{2} =$	$\frac{4}{5} + \frac{5}{6} =$	$\frac{8}{9} + \frac{5}{6} =$
6.	$\frac{1}{2} + \frac{3}{4} =$	$\frac{2}{3} + \frac{3}{5} =$	$\frac{7}{10} + \frac{3}{4} =$

Set III

7.	$\frac{1}{2} + \frac{5}{6} =$	$\frac{1}{4} + \frac{11}{12} =$	$\frac{1}{2} + \frac{9}{20} =$
8.	$\frac{5}{6} + \frac{2}{3} =$	$\frac{7}{10} + \frac{1}{2} =$	$\frac{7}{12} + \frac{3}{4} =$
9.	$\frac{3}{5} + \frac{9}{20} =$	$\frac{9}{20} + \frac{4}{5} =$	$\frac{23}{30} + \frac{5}{6} =$

Set IV

10.	$\frac{3}{4} + \frac{1}{12} + \frac{1}{3} =$	$\frac{8}{15} + \frac{2}{3} + \frac{3}{5} =$	$\frac{1}{4} + \frac{9}{10} + \frac{1}{2} =$
11.	$\frac{1}{5} + \frac{1}{6} + \frac{1}{2} =$	$\frac{11}{12} + \frac{1}{4} + \frac{2}{3} =$	$\frac{1}{2} + \frac{9}{10} + \frac{3}{4} =$
12.	$\frac{7}{8} + \frac{1}{4} + \frac{1}{2} =$	$\frac{5}{6} + \frac{8}{9} + \frac{1}{3} =$	$\frac{1}{6} + \frac{7}{8} + \frac{1}{4} =$

PROBLEMS ABOUT SCHOOL

1. There were 36 children in Harry's class at school. Each of them used a 5¢ pencil a month. Find the cost of the pencils used by the class in 9 months.

2. Each morning the arithmetic period began at 9:15 and ended at 10:00. How many minutes a week were spent on arithmetic? how many hours?

3. The reading period began at 10:45 and lasted until 11:30. How many minutes a week were spent on reading? How many hours a day was this?

4. Harry lived $\frac{1}{2}$ mile from school, John lived $\frac{1}{8}$ mile farther than Harry. How far from the school did John live?

5. For the hobby show the class sold 85 twenty-five-cent tickets and 30 fifteen-cent tickets. Find the amount of money the class obtained from the sale of tickets.

6. Harry received $6.25 for the twenty-five-cent tickets that he had sold. How many tickets did Harry sell?

7. Harry counted the tickets that had been sold. He counted 426 twenty-five-cent tickets and 198 fifteen-cent tickets. How much money was received from the sale of tickets?

8. At the school candy sale Jack bought $\frac{1}{4}$ pound of chocolate fudge, $\frac{1}{2}$ pound of vanilla fudge, and $\frac{1}{2}$ pound of nut candy. How much candy did he buy?

9. Harry had two prize apples. One weighed $\frac{3}{8}$ pound. The other weighed $\frac{1}{2}$ pound. Find the weight of the two apples.

10. During the first five weeks of school the deposits in the school savings bank were as follows: $8.75, $9.68, $10.25, $16.78, $25.40. Find the total amount of money deposited.

ADDING MIXED NUMBERS CONTAINING UNLIKE FRACTIONS

1. Mrs. Johnson bought two chickens. One weighed $3\frac{1}{2}$ pounds and the other $3\frac{1}{8}$ pounds. What did the chickens weigh?

$\begin{array}{r} 3\frac{1}{2} = 3\frac{4}{8} \\ 3\frac{1}{8} = 3\frac{1}{8} \\ \hline 6\frac{5}{8} \end{array}$	Think: $3\frac{1}{2}$ lb. + $3\frac{1}{8}$ lb. = ? lb. Change $3\frac{1}{2}$ to $3\frac{4}{8}$. Then add as with mixed numbers containing like fractions. The chickens weighed $6\frac{5}{8}$ pounds.

Study the following examples carefully until you understand how each of them was worked. Then copy the examples and work them with your book closed.

2. $\begin{array}{r} 4\frac{1}{4} = 4\frac{1}{4} \\ 3\frac{1}{2} = 3\frac{2}{4} \\ \hline 7\frac{3}{4} \end{array}$ **3.** $\begin{array}{r} 5\frac{1}{6} = 5\frac{2}{12} \\ 2\frac{7}{12} = 2\frac{7}{12} \\ \hline 7\frac{9}{12} = 7\frac{3}{4} \end{array}$ **4.** $\begin{array}{r} 7\frac{3}{4} = 7\frac{15}{20} \\ 6\frac{4}{5} = 6\frac{16}{20} \\ \hline 13\frac{31}{20} = 14\frac{11}{20} \end{array}$

Find the sums of the following:

	a	*b*	*c*	*d*	*e*
5.	$4\frac{1}{2}$ $5\frac{1}{4}$	$3\frac{1}{2}$ $4\frac{1}{8}$	$2\frac{1}{4}$ $5\frac{1}{8}$	$4\frac{5}{8}$ $3\frac{1}{4}$	$7\frac{1}{2}$ $6\frac{1}{6}$
6.	$4\frac{2}{3}$ $8\frac{1}{6}$	$6\frac{1}{2}$ $7\frac{1}{3}$	$5\frac{1}{2}$ $4\frac{1}{5}$	$3\frac{4}{5}$ $8\frac{1}{10}$	$2\frac{1}{2}$ $9\frac{3}{8}$
7.	$7\frac{1}{2}$ $8\frac{5}{6}$	$6\frac{3}{4}$ $3\frac{1}{2}$	$7\frac{3}{8}$ $9\frac{3}{4}$	$9\frac{1}{3}$ $8\frac{3}{5}$	$9\frac{7}{10}$ $7\frac{2}{5}$
8.	$7\frac{2}{2}$ $6\frac{7}{12}$	$8\frac{1}{2}$ $5\frac{2}{3}$	$6\frac{7}{8}$ $6\frac{1}{2}$	$6\frac{8}{9}$ $7\frac{2}{3}$	$4\frac{2}{3}$ $7\frac{3}{4}$
9.	$7\frac{1}{4}$ $5\frac{1}{2}$ $8\frac{1}{8}$	$6\frac{1}{3}$ $7\frac{5}{6}$ $3\frac{5}{12}$	$3\frac{5}{8}$ $4\frac{7}{8}$ $3\frac{1}{2}$	$1\frac{1}{2}$ $2\frac{2}{3}$ $7\frac{1}{4}$	$6\frac{1}{2}$ $9\frac{1}{5}$ $7\frac{9}{10}$

REPORTS OF TIME SPENT IN PRACTICING MUSIC

A teacher asked her pupils to keep a record of the time they spent practicing. Here are the reports of four girls.

	Mary	Alice	June	Edith
Monday	$\frac{1}{2}$ hr.	$\frac{3}{4}$ hr.	1 hr.	$\frac{3}{4}$ hr.
Tuesday	$1\frac{1}{4}$ hr.	$\frac{1}{4}$ hr.	$\frac{1}{2}$ hr.	$\frac{3}{4}$ hr.
Wednesday	1 hr.	1 hr.	$1\frac{1}{4}$ hr.	$1\frac{1}{2}$ hr.
Thursday	$\frac{3}{4}$ hr.	$1\frac{1}{4}$ hr.	1 hr.	0 hr.
Friday	1 hr.	$1\frac{1}{4}$ hr.	$\frac{3}{4}$ hr.	$\frac{1}{2}$ hr.
Saturday	$1\frac{1}{2}$ hr.	$1\frac{1}{2}$ hr.	$1\frac{1}{4}$ hr.	$\frac{3}{4}$ hr.

1. On what day did Mary practice the longest time?

2. On what days did Alice practice longer than Mary? how much longer?

3. Which girl practiced the longest time on Monday? on each of the other days?

4. Which girl practiced the shortest time on Monday? on each of the other days?

5. How many hours did Mary practice in the week?

6. How many hours did Alice practice in the week? June? Edith?

7. Which of the three girls practiced the most?

8. How many hours in all did the girls practice on Monday? on Tuesday? on Wednesday? on Thursday? on Friday? on Saturday?

9. One morning Mary practiced 30 minutes. What fraction of an hour is 30 minutes?

Express each of the following as a fraction of an hour:

10. 45 min.	15 min.	10 min.	20 min.
11. 40 min.	12 min.	24 min.	48 min.

DIAGNOSTIC TEST IN ADDITION OF FRACTIONS

This exercise will help you to tell whether you know how to work all kinds of addition examples. If you make any mistakes, find the reasons for your mistakes.

	a	*b*	*c*	*d*	*e*
1.	$\frac{1}{6}$ $\frac{1}{6}$	$\frac{1}{8}$ $\frac{5}{8}$	$\frac{1}{2}$ $\frac{1}{2}$	$\frac{4}{5}$ $\frac{2}{5}$	$\frac{3}{4}$ $\frac{3}{4}$
2.	5 $\frac{1}{4}$	$\frac{2}{3}$ 7	4 $1\frac{2}{3}$	$3\frac{1}{2}$ 8	$2\frac{1}{4}$ $\frac{1}{4}$ 4
3.	$3\frac{1}{5}$ $\frac{1}{5}$	$\frac{1}{4}$ $2\frac{1}{4}$	$2\frac{1}{3}$ $7\frac{2}{3}$	$3\frac{3}{5}$ $2\frac{4}{5}$	$5\frac{5}{6}$ $2\frac{5}{6}$
4.	$\frac{1}{2}$ $\frac{1}{4}$	$\frac{1}{2}$ $\frac{1}{6}$	$\frac{1}{4}$ $\frac{1}{4}$	$\frac{1}{3}$ $\frac{5}{6}$	$\frac{7}{12}$ $\frac{3}{4}$
5.	$3\frac{2}{3}$ $2\frac{1}{6}$	$1\frac{1}{4}$ $3\frac{7}{12}$	$1\frac{1}{4}$ $\frac{1}{4}$ $2\frac{1}{2}$	$7\frac{3}{4}$ 3 $3\frac{1}{2}$	$2\frac{2}{3}$ $7\frac{5}{6}$
6.	$\frac{1}{4}$ $\frac{1}{3}$	$\frac{1}{3}$ $\frac{1}{5}$ $\frac{3}{10}$	$\frac{3}{4}$ $\frac{1}{6}$ $\frac{1}{8}$	$\frac{3}{5}$ $\frac{1}{2}$ $\frac{1}{4}$	$\frac{2}{3}$ $\frac{4}{5}$ $\frac{7}{10}$
7.	$4\frac{1}{5}$ $1\frac{1}{4}$	$1\frac{1}{6}$ $7\frac{3}{5}$ $3\frac{1}{6}$	$\frac{5}{6}$ $\frac{3}{4}$ $\frac{5}{12}$	$6\frac{2}{3}$ $4\frac{3}{4}$	$5\frac{3}{5}$ $7\frac{1}{4}$ $\frac{1}{4}$
8.	$5\frac{5}{12}$ $\frac{5}{6}$	$\frac{5}{12}$ $1\frac{1}{3}$	$\frac{2}{3}$ $\frac{1}{4}$ $4\frac{1}{12}$	$\frac{2}{5}$ $1\frac{2}{3}$	$3\frac{1}{2}$ $4\frac{5}{6}$ $3\frac{5}{8}$

HOW TO PICTURE LARGE NUMBERS

Bar *A* below represents the amount of lumber cut in Georgia in a recent year, and bar *B* represents the amount cut in California and Nevada.

A **B**

1. Measure the length of the bar carefully with your ruler. Use a ruler marked in eighths of an inch. If one inch of the length of the bar stands for 1 billion board feet of lumber, how many billions were cut in Georgia during this year? in California and Nevada?

2. Draw bars $\frac{1}{2}$ inch wide to represent the amounts of lumber cut in each of the following states. Let 1 inch of length represent 1 billion board feet.

Washington	$6\frac{1}{4}$ billions	Alabama	$1\frac{7}{8}$ billions
Oregon	$3\frac{1}{2}$ billions	Texas	$1\frac{1}{2}$ billions
Louisiana	$3\frac{1}{4}$ billions	Wisconsin	$1\frac{1}{8}$ billions
Mississippi	$2\frac{3}{4}$ billions	Michigan	$\frac{3}{4}$ billion

Color these bars any color you wish. Do your work neatly.

3. How much longer than the bar for Oregon is the bar for Washington? Use your ruler to measure the difference.

4. Draw a bar to show the amount of lumber cut both in Louisiana and Mississippi. How long is this bar?

5. How much shorter than the bar for Oregon is the bar for Louisiana?

6. Draw a bar to show the amount of lumber cut in Wisconsin and Michigan. What is the length of this bar?

SUBTRACTING UNLIKE FRACTIONS

1. Mary's recipe for candy called for $\frac{3}{4}$ pound of sugar. She found that there was only $\frac{1}{2}$ pound in the sugar jar on the shelf. How much more sugar does Mary need?

$\frac{3}{4} = \frac{3}{4}$ $\frac{1}{2} = \frac{2}{4}$ $\frac{1}{4}$	Think: $\frac{3}{4}$ lb. $-$ $\frac{1}{2}$ lb. = ? lb. Before unlike fractions can be subtracted they must be changed to like fractions. Change $\frac{1}{2}$ to $\frac{2}{4}$. Then subtract.

Study the work in the following examples until you understand how each example was worked. Then copy the examples and work them with your book closed.

2. $\frac{7}{8} = \frac{7}{8}$, $\frac{3}{4} = \frac{6}{8}$; $\frac{1}{8}$

3. $\frac{7}{12} = \frac{7}{12}$, $\frac{1}{4} = \frac{3}{12}$; $\frac{4}{12} = \frac{1}{3}$

4. $\frac{3}{4} = \frac{15}{20}$, $\frac{2}{5} = \frac{8}{20}$; $\frac{7}{20}$

Subtract:

	a	*b*	*c*	*d*	*e*	*f*	*g*	*h*
5.	$\frac{1}{2}$ $\frac{1}{4}$	$\frac{7}{8}$ $\frac{1}{2}$	$\frac{3}{4}$ $\frac{5}{8}$	$\frac{2}{3}$ $\frac{1}{6}$	$\frac{3}{4}$ $\frac{1}{12}$	$\frac{1}{2}$ $\frac{1}{10}$	$\frac{2}{3}$ $\frac{1}{2}$	$\frac{5}{6}$ $\frac{7}{12}$
6.	$\frac{1}{2}$ $\frac{1}{6}$	$\frac{5}{6}$ $\frac{2}{3}$	$\frac{3}{4}$ $\frac{1}{6}$	$\frac{4}{5}$ $\frac{3}{4}$	$\frac{9}{10}$ $\frac{4}{5}$	$\frac{1}{2}$ $\frac{1}{3}$	$\frac{3}{4}$ $\frac{3}{8}$	$\frac{3}{8}$ $\frac{1}{6}$
7.	$\frac{7}{8}$ $\frac{1}{8}$	$\frac{8}{9}$ $\frac{4}{9}$	$\frac{11}{12}$ $\frac{1}{4}$	$5\frac{3}{4}$ $2\frac{1}{4}$	$6\frac{1}{8}$ $2\frac{3}{8}$	$7\frac{1}{3}$ $2\frac{1}{3}$	8 $6\frac{3}{4}$	$\frac{17}{20}$ $\frac{1}{2}$
8.	$7\frac{1}{6}$ $\frac{5}{6}$	$4\frac{1}{2}$ 3	$\frac{9}{10}$ $\frac{4}{5}$	$6\frac{7}{8}$ $6\frac{7}{8}$	83 $8\frac{1}{5}$	$6\frac{7}{12}$ $2\frac{5}{12}$	$8\frac{1}{2}$ $4\frac{1}{2}$	$\frac{9}{16}$ $\frac{5}{16}$

9. Alice has a piece of ribbon $\frac{7}{8}$ yard long. She cut off a piece of the ribbon $\frac{1}{4}$ yard long. How long is the piece that is left?

10. How much less than $\frac{5}{12}$ is $\frac{1}{4}$?

SUBTRACTING MIXED NUMBERS

1. Mary weighed $67\frac{1}{2}$ pounds. Kate weighed $58\frac{1}{4}$ pounds. How much more than Kate did Mary weigh?

$67\frac{1}{2}$ lb. − $58\frac{1}{4}$ lb. = ? $67\frac{1}{2} = 67\frac{2}{4}$ $58\frac{1}{4} = 58\frac{1}{4}$ $9\frac{1}{4}$	Change $\frac{1}{2}$ and $\frac{1}{4}$ to like fractions. $\frac{1}{2} - \frac{1}{4} = \frac{2}{4} - \frac{1}{4} = \frac{1}{4}$. Subtract the integers: $67 - 58 = 9$. The difference is $9\frac{1}{4}$. Mary weighs $9\frac{1}{4}$ lb. more than Kate.

2. John is $54\frac{5}{8}$ inches tall. Harry is $51\frac{1}{4}$ inches tall. How much shorter than John is Harry?

3. John weighed $91\frac{1}{2}$ pounds and Harry weighed $93\frac{5}{8}$ pounds. How much less than Harry did John weigh?

Find the differences:

4. $6\frac{7}{8}$ $1\frac{1}{2}$	**7.** $12\frac{3}{4}$ $4\frac{1}{2}$	**10.** $47\frac{11}{12}$ $23\frac{5}{6}$	**13.** $25\frac{5}{8}$ $13\frac{1}{2}$
5. $9\frac{1}{2}$ $2\frac{1}{3}$	**8.** $12\frac{3}{4}$ $5\frac{1}{6}$	**11.** $195\frac{3}{5}$ $88\frac{1}{4}$	**14.** $18\frac{5}{6}$ $7\frac{2}{3}$
6. $359\frac{3}{4}$ $157\frac{2}{3}$	**9.** $46\frac{5}{9}$ $24\frac{1}{3}$	**12.** $7\frac{5}{6}$ $2\frac{2}{5}$	**15.** $19\frac{1}{5}$ $12\frac{1}{8}$

16. Subtract seven and three-tenths from nine and three-fourths.

17. Find the difference between $18\frac{5}{6}$ and $14\frac{3}{8}$.

QUICK REVIEW OF ADDITION

Practice until you can do these in less than five minutes.

1. $\frac{4}{5}$ $\frac{7}{10}$ $\frac{1}{2}$	**2.** $\frac{1}{4}$ $\frac{1}{3}$ $\frac{1}{12}$	**3.** $6\frac{1}{4}$ $2\frac{1}{2}$ $5\frac{3}{4}$	**4.** $2\frac{2}{3}$ $5\frac{1}{6}$ $7\frac{1}{2}$	**5.** $5\frac{7}{8}$ $9\frac{7}{8}$ $6\frac{1}{2}$	**6.** $3\frac{3}{4}$ $2\frac{1}{2}$ $5\frac{1}{8}$

A NEW STEP IN SUBTRACTING FRACTIONS

1. A dressmaker cut $4\frac{3}{4}$ yards of cloth from a piece $14\frac{1}{2}$ yards long. How much cloth was left in the longer piece?

$14\frac{1}{2}$ yd. $-$ $4\frac{3}{4}$ yd. $=$? $14\frac{1}{2} = 13\frac{6}{4}$ $\underline{4\frac{3}{4} = 4\frac{3}{4}}$ $\phantom{14\frac{1}{2} = 1}9\frac{3}{4}$	To give both fractions the same denominator, change $\frac{1}{2}$ to $\frac{2}{4}$. Since $\frac{3}{4}$ cannot be subtracted from $\frac{2}{4}$, change $14\frac{1}{2}$ to $13\frac{6}{4}$. Subtract: $\frac{6}{4} - \frac{3}{4} = \frac{3}{4}$. Subtract: $13 - 4 = 9$. $9\frac{3}{4}$ yd. left in the longer piece.

Study the following examples carefully. Copy and work them with your book closed.

2.
$$\begin{array}{lr} 7\frac{1}{2} = 7\frac{2}{4} = & 6\frac{6}{4} \\ \underline{4\frac{3}{4} \qquad\quad =} & \underline{4\frac{3}{4}} \\ & 2\frac{3}{4} \end{array}$$

3.
$$\begin{array}{lr} 9\frac{1}{3} = 9\frac{2}{6} = & 8\frac{8}{6} \\ \underline{4\frac{5}{6} \qquad\quad =} & \underline{4\frac{5}{6}} \\ & 4\frac{3}{6} = 4\frac{1}{2} \end{array}$$

4. Practice changing the following numbers to the form used in problem **1**.

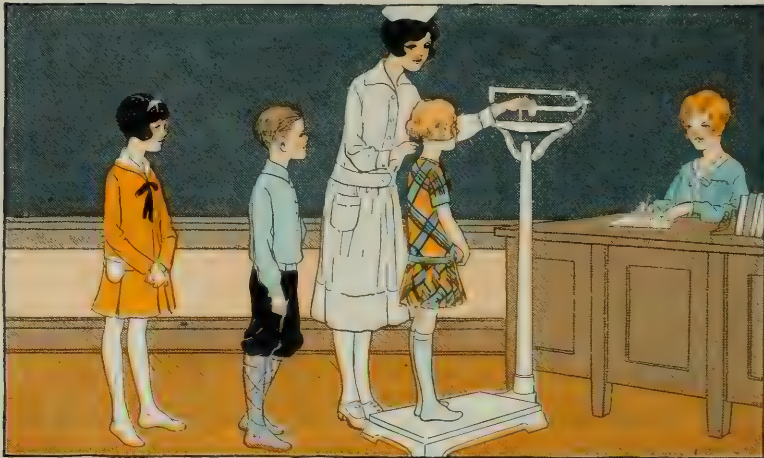
$6\frac{1}{2} = 5\frac{}{4}$ $\qquad 7\frac{1}{3} = 6\frac{}{6}$ $\qquad 9\frac{1}{4} = 8\frac{}{8}$ $\qquad 7\frac{1}{5} = 6\frac{}{10}$

$7\frac{3}{4} = 6\frac{}{8}$ $\qquad 8\frac{2}{3} = 7\frac{}{6}$ $\qquad 7\frac{5}{6} = 6\frac{}{12}$ $\qquad 8\frac{4}{5} = 7\frac{}{15}$

5. If the dressmaker cut $4\frac{7}{8}$ yards from a piece of cloth $9\frac{3}{4}$ yards long, how much would still remain to be used?

Find the differences:

6. $7\frac{1}{2}$ $\underline{2\frac{3}{4}}$	**9.** $5\frac{2}{3}$ $\underline{1\frac{5}{6}}$	**12.** $14\frac{1}{4}$ $\underline{7\frac{1}{3}}$	**15.** $8\frac{5}{9}$ $\underline{2\frac{2}{3}}$
7. $8\frac{1}{3}$ $\underline{4\frac{5}{6}}$	**10.** $8\frac{1}{2}$ $\underline{4\frac{3}{5}}$	**13.** $15\frac{2}{3}$ $\underline{9\frac{3}{4}}$	**16.** $4\frac{1}{3}$ $\underline{8\frac{5}{8}}$
8. $7\frac{3}{8}$ $\underline{4\frac{1}{2}}$	**11.** $12\frac{1}{2}$ $\underline{4\frac{2}{3}}$	**14.** $10\frac{1}{3}$ $\underline{8\frac{3}{4}}$	**17.** $15\frac{1}{8}$ $\underline{14\frac{1}{2}}$



WEIGHING BOYS AND GIRLS

The boys and girls of the Lincoln School were weighed each month by the school nurse. These are the weights of six of the children on January 15 and on February 15:

	Weight in Pounds					
Date	Tom	Ethel	May	Willie	John	Elsie
Jan. 15........	$84\frac{1}{4}$	$86\frac{1}{2}$	$80\frac{1}{8}$	$87\frac{1}{4}$	$82\frac{3}{4}$	$90\frac{3}{4}$
Feb. 15........	$84\frac{1}{2}$	$85\frac{3}{4}$	$81\frac{1}{2}$	88	$83\frac{1}{4}$	$88\frac{1}{2}$

1. Which of the children gained in weight?

2. Which of the children lost in weight?

3. How much did each of those who gained increase in weight? Who gained the most?

4. How much did each of those who lost in weight lose?

5. Keep a record of your own weight for three months.

6. Are there any children in your room who weigh as much as one of these six children weighed?

DIAGNOSTIC TEST IN SUBTRACTING FRACTIONS

This exercise will help you to tell whether you know how to subtract fractions of all kinds. If you work any of the examples incorrectly, find the reasons for your mistakes.

	a	*b*	*c*	*d*	*e*
1.	$\frac{2}{3}$ $\frac{1}{3}$	$\frac{5}{8}$ $\frac{1}{8}$	$4\frac{4}{5}$ $\frac{1}{5}$	$4\frac{2}{3}$ $\frac{2}{3}$	$7\frac{5}{6}$ $\frac{1}{6}$
2.	$5\frac{1}{4}$ 3	$2\frac{1}{8}$ 2	$4\frac{3}{5}$ $2\frac{1}{5}$	$3\frac{3}{4}$ $2\frac{3}{4}$	$7\frac{5}{8}$ $2\frac{3}{8}$
3.	9 $\frac{1}{2}$	1 $\frac{1}{4}$	3 $1\frac{2}{3}$	6 $5\frac{2}{5}$	$2\frac{1}{8}$ $\frac{1}{8}$
4.	$6\frac{1}{3}$ $\frac{2}{3}$	$7\frac{1}{8}$ $\frac{5}{8}$	$10\frac{1}{3}$ $3\frac{2}{3}$	$9\frac{3}{5}$ $8\frac{4}{5}$	$4\frac{1}{6}$ $1\frac{5}{6}$
5.	$\frac{1}{2}$ $\frac{1}{4}$	$\frac{1}{2}$ $\frac{1}{6}$	$3\frac{3}{4}$ $\frac{1}{2}$	$6\frac{1}{4}$ $6\frac{1}{8}$	$4\frac{1}{3}$ $1\frac{1}{12}$
6.	$7\frac{1}{2}$ $4\frac{2}{4}$	$3\frac{5}{6}$ $1\frac{2}{3}$	$7\frac{3}{5}$ $1\frac{1}{10}$	$2\frac{3}{8}$ $\frac{5}{6}$	$3\frac{1}{4}$ $\frac{11}{12}$
7.	$\frac{1}{3}$ $\frac{1}{4}$	$\frac{3}{4}$ $\frac{1}{6}$	$2\frac{3}{8}$ $\frac{1}{3}$	$4\frac{5}{6}$ $\frac{3}{8}$	$1\frac{1}{8}$ $\frac{1}{3}$
8.	$4\frac{5}{6}$ $1\frac{11}{12}$	$3\frac{5}{8}$ $1\frac{1}{6}$	$3\frac{1}{4}$ $\frac{2}{3}$	$8\frac{1}{8}$ $1\frac{1}{2}$	$7\frac{1}{8}$ $\frac{1}{4}$
9.	$3\frac{7}{8}$ $1\frac{11}{12}$	$4\frac{1}{4}$ $\frac{5}{6}$	$3\frac{5}{6}$ $1\frac{3}{4}$	$5\frac{1}{5}$ $\frac{2}{3}$	$7\frac{1}{5}$ $6\frac{3}{4}$

Practice on examples similar to those that you worked incorrectly.

EVERYDAY USE OF FRACTIONS

1. A cake was cut into four equal pieces. Two of the pieces were eaten. What part of the cake was left?

2. An apple was cut into four equal parts. Harry received one part and John three parts. What fraction of the apple did each receive?

3. One-fourth mile of a road was paved with brick and $\frac{1}{4}$ mile was paved with cement. How much was paved?

4. Mary's mother poured $\frac{1}{2}$ pint of milk and $\frac{1}{8}$ pint of water into a bottle. How much was then in the bottle?

5. Margaret practiced her music lesson $\frac{1}{2}$ hour in the morning and $\frac{1}{4}$ hour in the afternoon. How much longer than in the afternoon did she practice in the morning? How much did she practice in all?

6. Janet painted $\frac{1}{4}$ of a page red and $\frac{2}{4}$ of it blue. The rest was unpainted. How much was unpainted?

7. It was $\frac{1}{2}$ mile north from the store to the corner and $\frac{3}{4}$ mile west from the corner to Alice's home. How far was it by the road from the store to her home?

8. John had a package containing $\frac{1}{2}$ pound of meat and $\frac{3}{4}$ pound of dog biscuit for his puppy, Bob. What did the two foods weigh together?

Find the answers to the following:

9.	$\frac{7}{8}$ mile − $\frac{1}{4}$ mile = ?	15.	$2\frac{1}{2} - 1\frac{1}{2} =$
10.	$\frac{3}{4}$ pound + $\frac{7}{8}$ pound = ?	16.	$6\frac{2}{3} + 4\frac{2}{3} =$
11.	$\frac{2}{3}$ hour − $\frac{1}{2}$ hour = ?	17.	$8\frac{1}{4} - 3\frac{3}{4} =$
12.	$\frac{3}{4}$ yard + $\frac{1}{2}$ yard = ?	18.	$\frac{7}{8} + \frac{5}{8} =$
13.	$\frac{5}{6}$ in. − $\frac{1}{3}$ in. = ?	19.	$3\frac{1}{6} - 2\frac{1}{5} =$
14.	$\frac{1}{2}$ yd. + $\frac{1}{3}$ yd. = ?	20.	$5\frac{2}{7} + 6\frac{4}{7} =$

21. Mrs. Bailey used $\frac{1}{4}$ pound of butter for cakes and $\frac{1}{8}$ pound for candy. How much butter did she use for cakes and candy?

22. Mary was $62\frac{1}{2}$ inches tall, and Jane was $64\frac{3}{4}$ inches tall. Find the difference in their heights.

23. In June Mary weighed $84\frac{1}{2}$ pounds. After the summer vacation she weighed $87\frac{1}{2}$ pounds. How much had she gained in weight?

24. Mrs. Jones bought two chickens for dinner. One weighed $3\frac{1}{4}$ pounds and the other weighed $2\frac{1}{8}$ pounds. Find the weight of the two chickens.

25. Mrs. Jones had a piece of cloth $9\frac{1}{4}$ yards long and cut off $2\frac{1}{2}$ yards. What was the length of the piece that was left?

26. The prize pig at the fair weighed $486\frac{1}{4}$ pounds. John's pig weighed $397\frac{1}{2}$ pounds. How much less than the prize pig's weight did John's pig weigh?

27. Before leaving for her summer vacation, Susan weighed $87\frac{1}{2}$ pounds. When she returned, she weighed $90\frac{1}{4}$ pounds. How many pounds did she gain in weight?

ON A HIKE

1. Bob and Herbert went on a hike one Saturday. They left home at 7:45 A.M. It took them $\frac{3}{4}$ of an hour to walk to their Uncle Tom's farm. What time was it when they reached there?

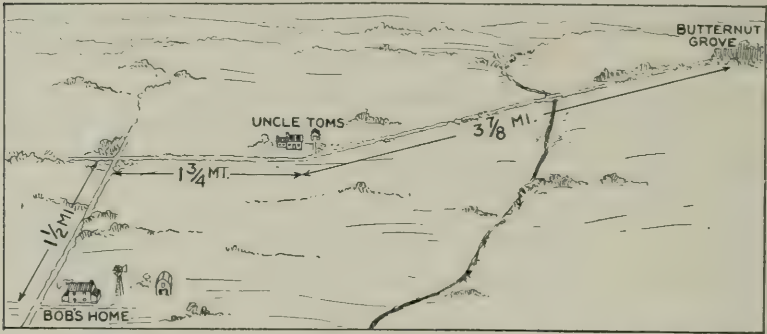
2. The hickory trees were on their uncle's farm. After the boys had picked as many nuts as they wished, they weighed their sacks on the scales in Uncle Tom's barn. Bob's sack weighed $3\frac{1}{2}$ pounds and Herb's sack weighed $4\frac{1}{4}$ pounds. How much did both sacks weigh?

3. While at dinner Bob asked his uncle how many acres there were in a farm. Uncle Tom said there were 160 acres in his farm. His neighbor, Mr. Smith, had 220 acres, and Mr. Olson, who lived near by, had 84 acres. Mr. Rice, another neighbor, owned 120 acres. What was the average number of acres in these farms?

4. Uncle Tom said land was valued at $157 an acre. At this rate find the value of each of these farms.

5. Uncle Tom paid $33,600 for his farm. How much did it cost an acre?

6. Mr. Olson purchased his farm for $14,700. How much was this an acre?



7. Here is a map of the roads over which the boys traveled. How far is it from Bob's home to the butternut grove?

8. The boys picked two sacks of butternuts. One sack of nuts weighed $3\frac{7}{8}$ pounds and the other $4\frac{3}{4}$ pounds. What did they both weigh?

9. As the boys were tired, their uncle took them home in his car. It took only 10 minutes to drive to their house. What fraction of an hour is this?

REVIEW OF IMPORTANT POINTS

This exercise will review the important points that you have learned.

1. Are $\frac{1}{3}$ and $\frac{2}{3}$ like fractions?

2. Write two unlike fractions.

3. What is the numerator of the fraction $\frac{7}{8}$? the denominator?

4. $2\frac{1}{2}$ is a —— number.

5. $\frac{11}{3}$ is an —— fraction.

6. Reduce $\frac{9}{12}$ to lowest terms.

7. Change $\frac{11}{5}$ to a mixed number.

8. Fill in the blanks. $\frac{2}{3} = \frac{}{6}, \frac{}{12}, \frac{}{9}, \frac{}{15}$.

9. How can you find a common denominator for $\frac{1}{4}$ and $\frac{4}{5}$?

10. Fill in the blanks. $1\frac{1}{4} = \frac{}{4}$; $2\frac{1}{4} = 1\frac{}{4}$.

11. Change $5\frac{9}{6}$ to simplest form.

12. What common denominator will you use in each of these examples?

$$\frac{1}{2} + \frac{4}{5} + \frac{3}{10} = \qquad \frac{1}{2} + \frac{1}{3} + \frac{1}{4} = \qquad \frac{1}{2} + \frac{1}{6} + \frac{1}{8} =$$

13. Explain each step in finding the answer to this example:

$$4\frac{1}{4} - 2\frac{1}{2} =$$

14. Show by a drawing that $\frac{1}{2} = \frac{4}{8}$.

15. Show by a drawing that $1 = \frac{4}{4}$ or $\frac{8}{8}$.

16. Show that $8\frac{1}{3}$ equals $7\frac{4}{3}$.

17. Change the following to their simplest form:

$$\frac{12}{8} \qquad 1\frac{9}{8} \qquad 10\frac{12}{5} \qquad 16\frac{16}{4} \qquad 9\frac{15}{10}$$

18. Supply the missing numbers:

$$3\frac{1}{2} = 2\frac{}{4} \qquad 5\frac{1}{2} = 4\frac{}{8} \qquad 7\frac{2}{3} = 6\frac{}{9} \qquad 8\frac{3}{4} = 7\frac{}{16}$$

PROBLEMS ABOUT RAINFALL

In your work in geography you have learned that the amounts of rainfall in different parts of our country are not equal. This exercise will give you information about the amount of rain and snow that fall each month in North Dakota and Louisiana.

North Dakota				Louisiana			
Month	Inches	Month	Inches	Month	Inches	Month	Inches
Jan.....	$\frac{1}{2}$	July....	$2\frac{1}{4}$	Jan.....	$4\frac{1}{2}$	July...	$6\frac{1}{2}$
Feb.....	$\frac{3}{4}$	Aug....	$2\frac{1}{4}$	Feb.....	$4\frac{1}{2}$	Aug...	$5\frac{1}{2}$
Mar....	$1\frac{1}{4}$	Sept....	$1\frac{1}{4}$	Mar....	$5\frac{1}{4}$	Sept...	$4\frac{3}{4}$
Apr.....	$1\frac{3}{4}$	Oct.....	$1\frac{1}{4}$	Apr....	5	Oct....	3
May....	$2\frac{1}{2}$	Nov....	$\frac{3}{4}$	May....	$3\frac{3}{4}$	Nov...	$3\frac{3}{4}$
June....	$3\frac{1}{2}$	Dec.....	$\frac{1}{2}$	June..	$6\frac{1}{4}$	Dec....	$4\frac{1}{2}$

1. In what month does the largest amount of rain and snow fall in North Dakota? in Louisiana?

2. What is the total rainfall in the first six months in North Dakota? in Louisiana?

3. How much more rain falls in Louisiana in the first six months than falls in North Dakota?

4. How much more or less rain falls in the first six months in North Dakota than falls in the second six months?

5. Find the total yearly rainfall in North Dakota.

6. Find the total yearly rainfall in Louisiana.

7. Make a table showing how much more rain falls each month in Louisiana than falls in North Dakota. Begin your table this way:

Month	North Dakota	Louisiana	Difference
January	$\frac{1}{2}$ in.	$4\frac{1}{2}$ in.	?

PRACTICE TESTS IN THE FUNDAMENTALS

You should be able to find the answers to the examples and to check your work in the time allowed. When necessary, copy the examples before counting time.

Addition Test (8 minutes)

1.	2.	3.	4.	5.	6.
564	725	391	847	864	784
934	543	322	298	170	213
478	653	963	573	246	813
625	756	447	855	228	221
697	648	589	997	879	726
269	759	798	418	136	318

Subtraction Test (5 minutes)

1.	3.	5.	7.	9.	11.
7,710	5,715	6,000	5,386	4,578	6,432
1,789	1,579	4,896	3,479	3,798	6,426

2.	4.	6.	8.	10.	12.
4,992	9,795	6,120	3,899	9,617	9,652
2,894	6,676	3,142	2,005	1,010	2,819

Multiplication Test (9 minutes)

1.	3.	5.	7.	9.	11.
348	463	278	914	641	167
28	74	95	63	59	82

2.	4.	6.	8.	10.	12.
187	375	592	529	826	365
47	36	208	704	630	950

Division Test (10 minutes)

1. 42)8,944	3. 74)39,590	5. 45)15,894	7. 67)47,202
2. 68)34,884	4. 37)17,020	6. 94)92,176	8. 87)522,696

Do additional work on the processes in which your scores are lowest.

PROBLEM SCALE II

Standards	
Excellent.....	9 or 10 correct
Good.........	7 or 8 correct
Fair..........	5 or 6 correct
Unsatisfactory	0 to 4 correct

1. Jack has $3.20 and Helen has $1.85. How much less than Jack does Helen have?

2. If tablets cost 5¢ each, how much would 45 tablets cost?

3. How many pencils at 3¢ each can you buy for $1.20?

4. Helen had 25 cents. She bought 2 apples at 4 cents each. How much money did she have left?

5. An apple orchard has 180 trees planted in rows. There are 15 trees in each row. How many rows are there?

6. Jack, Paul, and George planned a hike. They bought a loaf of bread for 10 cents, 14 cents worth of butter, and 15 cents worth of ham. They divided the cost equally among them. What did each boy pay?

7. Ruth wished to buy a class pin which cost 90 cents. She had 65 cents, but had to spend 10 cents of it for pencils. How much more did she need?

8. Jane sold 2 dozen eggs at 20 cents a dozen. Her mother said she might use the money to buy cloth for a dress. If Jane needed 2 yards of cloth for the dress, how much could she pay a yard?

9. Frank sells 10 papers a day and gains 2 cents on each paper. How long will it take to earn enough to buy a pocket knife which costs 80 cents?

10. Three boys went to visit a cousin. Each of them spent 20¢ for street car fare. On the way they spent 30¢ for candy. What was the total cost of the trip?

CHAPTER III

A STATEMENT OF MONEY RECEIVED AND PAID OUT

When Tom was in the fourth grade, he learned to keep a cash account. Now he wishes to keep a classified record of the money that he spends. Here is his record without the totals for the various items. He deposits in the savings bank what he does not spend.

DATE	CASH RECEIVED	CASH PAID OUT	SAVINGS BANK DEPOSITS	PAYMENTS CLASSIFIED					
				CLOTHES	AMUSEMENTS	GIFTS	REPAIRS	PLAYTHINGS	SCHOOL BOOKS
19— Oct.	10 75	?	?	3 50	50			05	1 05
Nov.	8 75	?	?	1 50	1 50		75		10
Dec.	13 48	?	?	1 90	95	3 50		15	
Jan.	10 40	?	?	5 00	1 15		48	20	
Feb.	8 50	?	?		75	1 00	1 50		2 75
Total	?	?	?	?	?	?	?	?	?

1. Copy Tom's record and find the missing items. The totals should be placed where the ?'s are shown in the cashbook.

2. Does his total savings agree with the difference between the cash he received and what he paid out? If it does not, check your work.

***3.** Keep a record of cash received and paid out by you in the next two weeks.

ADDING LONGER COLUMNS

Practice the following examples until you can find the sums and check your work in less than fifteen minutes.

1.	2.	3.	4.	5.	6.
697	435	653	958	498	176
485	740	876	489	574	552
564	867	584	790	653	236
353	982	439	606	979	831
721	993	687	375	886	679
840	229	765	885	329	814
189	347	458	979	108	638

SPECIAL WORK IN SUBTRACTION

The following subtraction examples contain zeros. Practice until you can work the examples without mistakes.

1. 3,460	**4.** 4,604	**7.** 3,064	**10.** 3,004	**13.** 4,002
1,436	1,275	2,189	1,012	2,960
2. 4,970	**5.** 7,088	**8.** 7,904	**11.** 8,010	**14.** 8,600
3,082	2,317	3,506	1,474	5,700
3. 6,000	**6.** 9,006	**9.** 9,001	**12.** 8,005	**15.** 9,060
1,999	2,251	3,655	2,839	8,807

SPECIAL WORK IN MULTIPLICATION

The examples below will give you practice in working with zeros in multiplication.

1. 804	**3.** 740	**5.** 900	**7.** 8,050	**9.** 6,000
25	36	48	96	73
2. 975	**4.** 968	**6.** 894	**8.** 6,008	**10.** 4,060
250	100	704	900	9,005

DIVIDING BY NUMBERS ENDING IN ZERO

1. If the price of a tablet is 10¢, how many tablets can be bought for 50¢? for $5.00?

Think:	50 ÷ 10 = ?	500 ÷ 10 = ?
	50 ÷ 10 = 5	**500 ÷ 10 = 50**

To divide a number ending in zeros by 10, drop one zero. To divide by 100, drop two zeros.

Give the answers:

	a	b	c
2.	300 ÷ 10 =	300 ÷ 100 =	350 ÷ 10 =
3.	250 ÷ 10 =	2,500 ÷ 10 =	1,650 ÷ 10 =
4.	400 ÷ 100 =	5,000 ÷ 100 =	5,000 ÷ 100 =
5.	160 ÷ 10 =	2,400 ÷ 100 =	2,790 ÷ 10 =

6. If a pail holds 20 quarts, how many times must it be emptied to fill a tank which holds 320 quarts?

$\begin{array}{r} \mathbf{16} \\ \mathbf{2\cancel{0}}\overline{)\mathbf{32\cancel{0}}} \end{array}$	First cancel a zero in 320 and 20. Then divide by 2. Check. 20 × 16 = 320.

In working these examples, first cancel zeros, then divide.

	a	b	c
7.	$20\overline{)160}$	$200\overline{)1,600}$	$80\overline{)720}$
8.	$20\overline{)180}$	$300\overline{)1,500}$	$700\overline{)4,900}$
9.	$40\overline{)240}$	$400\overline{)3,200}$	$200\overline{)4,800}$
10.	$60\overline{)360}$	$500\overline{)3,500}$	$600\overline{)9,600}$
11.	$90\overline{)810}$	$600\overline{)4,800}$	$700\overline{)11,200}$
12.	$70\overline{)420}$	$800\overline{)5,600}$	$400\overline{)37,600}$

A SCHOOL FIELD MEET

1. John, Harry, and Peter were entered in the broad jump. John's best jump was 12 feet $6\frac{1}{4}$ inches. Harry's best jump was 12 feet $6\frac{7}{8}$ inches. Peter's best jump was 12 feet $6\frac{1}{2}$ inches. Who won the event?

2. How much farther than Peter did Harry jump?

3. How much farther than John did Peter jump?

4. The record for a 50-yard dash for fifth-grade boys was $7\frac{1}{5}$ seconds. The boy who won the race ran it in $7\frac{3}{5}$ seconds. How much slower than the record was this?

5. In the girls' 50-yard dash the time was $8\frac{2}{5}$ seconds. How much more than the time for the boys' record of $7\frac{1}{5}$ seconds was this? How much more than the time for the winner of the boys' race was it?

6. At the close of the meet, Whittier School had $18\frac{1}{4}$ points, Longfellow $28\frac{3}{4}$, Calhoun $37\frac{1}{2}$, and Roosevelt $46\frac{1}{2}$. How many points more than Longfellow did Roosevelt have?

7. How many points did all four schools score?

MEASURING DISTANCES

Table of Length		
12	inches (in.)	= 1 foot (ft.)
3	feet	= 1 yard (yd.)
$16\frac{1}{2}$	feet	= 1 rod (rd.)
$5\frac{1}{2}$	yards	= 1 rod
1,760	yards	= 1 mile (mi.)
320	rods	= 1 mile
5,280	feet	= 1 mile

1. How wide is your desk? Estimate the width and check by measuring with a ruler.

2. How wide is this book?

3. Without a ruler, draw a line on the blackboard 1 yard long. Check the length of your line with a ruler.

4. Mark on the floor a distance that you think is equal to a rod. Then check with a ruler.

5. Name some place a mile from your school. Name a city 100 miles from your school.

HEIGHTS AND WEIGHTS

1. Who is the tallest boy in your room? How tall is he? Measure his height.

2. Who is the shortest boy in your room? How tall is he?

3. How much taller than the shortest girl is the tallest girl in your class?

4. Have three people measure your height. Are the measurements all the same?

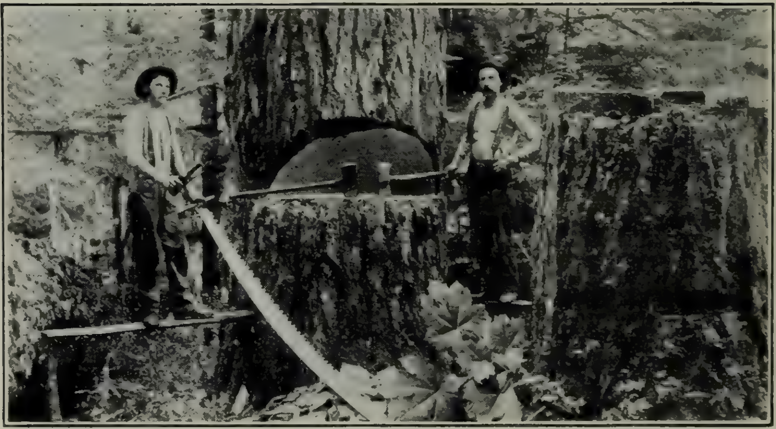
5. Find the average weight of the boys in your row.

6. Find the average weight of the girls in your row.

7. How can you find your increase in weight during a two-months period?

8. How can you find your average gain in weight a month during a school year?

9. How much more than a ton does a 3,275-pound load of coal weigh?



ARITHMETIC IN PICTURES

1. How thick is this tree? Why do you think so?

2. How long is the saw? Why must its length be greater than the thickness of the tree?

3. Explain just how you would find the distance around the tree. Measure the distance around some tree in your school yard.

4. Do you think this tree is more than 30 feet high? Explain.

5. How far above the ground are the men chopping? Why are they not chopping nearer the ground?

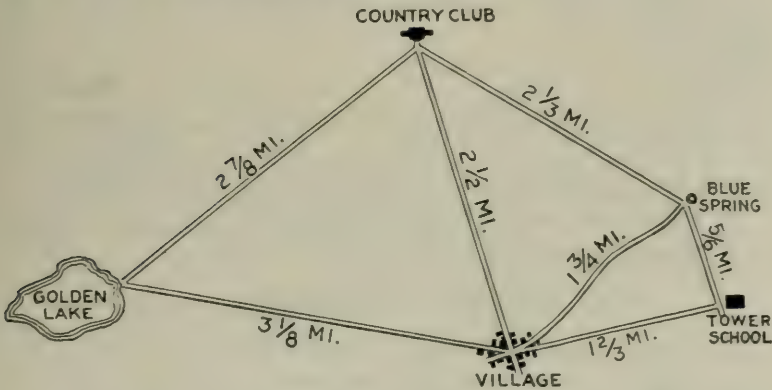
6. Why will the tree fall toward the side on which the men are chopping? Why did they saw on the other side?

7. Describe the cut the men are making in the tree.

8. Are trees ever larger than the one shown in the picture? Where are the largest trees in America found? Learn about their size.

HIKES BY GIRL SCOUTS

In the village there is a troup of Girl Scouts. Below is a copy of a map which they drew.



1. How far is it from the village to the Country Club by way of Golden Lake?

2. How much farther is it from the village to Golden Lake than it is from the village to the Country Club?

3. The girls took a hike to Blue Spring, by way of the Country Club. How many miles long was their hike?

4. They came home by way of Tower School. How many miles was this?

5. How far did they walk that day?

6. How much farther than to Tower School is the distance from the village to Blue Spring?

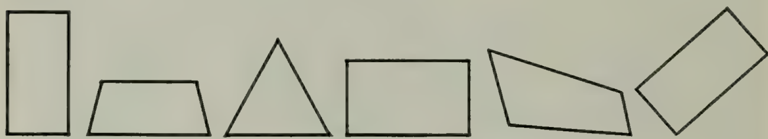
7. How far is it to Golden Lake and home again?

8. How much shorter than the distance from the village to the Country Club is the distance from the village to Blue Spring?

LEARNING ABOUT RECTANGLES

Any surface that is bounded by four straight lines and has four square corners or *angles* is called a *rectangle*.

1. Which of the following figures are rectangles? Tell why.

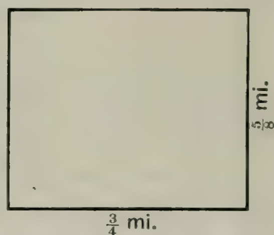


2. Which are not rectangles? Tell why.

3. Point to rectangles in your class room.

FINDING PERIMETERS

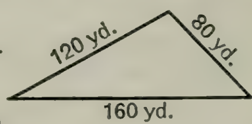
1. John's father owned a rectangular farm. One day John walked around the outer edge of it. The farm was $\frac{3}{4}$ mile long and $\frac{5}{8}$ mile wide. How far did he walk?



The distance around a surface is called its *perimeter*.

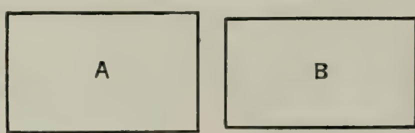
2. Find the perimeter of a garden 30 feet long and $27\frac{1}{2}$ feet wide.

3. Find the perimeter of this three-cornered field.



4. John had a rectangular garden 20 feet long and 18 feet wide. What would be the cost of enough wire at 5¢ a foot to go around the garden?

5. Which of these two rectangles has the larger perimeter? how much larger?



MEANING OF AREA AND DIMENSIONS

1. Which of these two rectangles takes up more space?

The space inclosed by a perimeter is called *area*.

We say that rectangle *B* has a greater area than rectangle *A* because *B* takes up more space.

The area of a farm means the space or surface it covers. A large farm has a greater area than a small farm.

2. Measure the length of rectangle *A*; of rectangle *B*.

3. Which has the greater width?

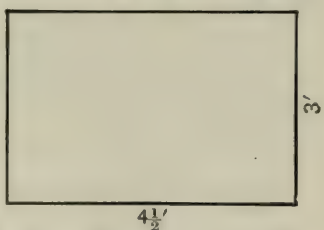
The length and the width of a rectangle are called its *dimensions*.

4. The dimensions of rectangle *A* are —— inches and —— inches.

5. What are the dimensions of rectangle *B*?

6. Draw a rectangle whose dimensions are 4 inches and 3 inches.

7. Draw a rectangle whose dimensions are $3\frac{1}{2}$ inches and $2\frac{1}{4}$ inches. These dimensions can be written: $3\frac{1}{2}'' \times 2\frac{1}{4}''$. This is read $3\frac{1}{2}$ inches by $2\frac{1}{4}$ inches.



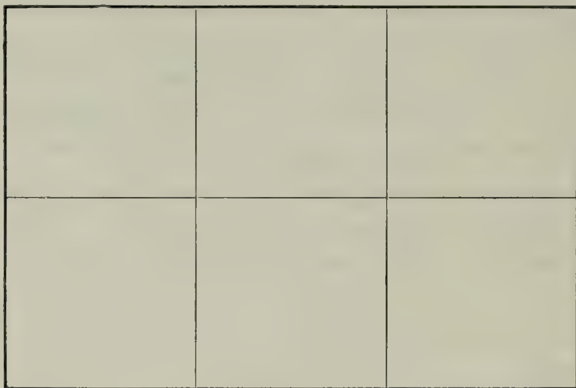
8. Write the dimensions of the rectangle at the right.

9. What are the dimensions of this arithmetic book? the floor of your class room? the kitchen in your home?

MEASURING AREAS

1. A square 1 inch long and 1 inch wide covers an area equal to a *square inch.* Cut out six such squares.

2. How many square inches will it take to cover this rectangle, which is 3 inches long and 2 inches wide?



3. How many rows of squares, each containing 3 square inches, are there? There are, therefore, 2×3 square inches.

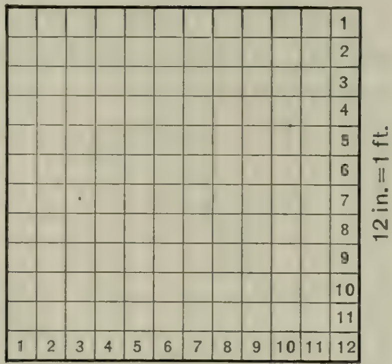
To find the area of a rectangle, multiply the length by the width.

4. What is the area of a rectangle 3 inches by 4 inches?

Find the areas of the following rectangles:

5. 3 in. by 6 in.
6. 4 in. by 8 in.
7. 5 in. by 7 in.
8. 6 in. by 4 in.
9. 8 in. by 8 in.
10. 6 in. by 1 in.
11. 2 in. by 14 in.
12. 9 in. by 12 in.
13. 7 in. by 9 in.
14. 12 in. by 6 in.

1. Draw a square on the blackboard 1 foot long and 1 foot wide. The area of this square is equal to a *square foot.*

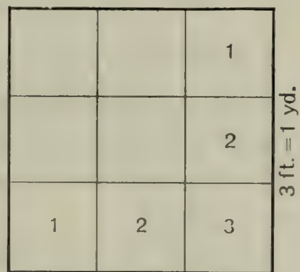


12 in. = 1 ft.

2. How many square inches are there in a square each of whose sides is one foot in length?

Think: Length is 1 foot or 12 inches. Width is 1 foot or 12 inches. The area: $12 \times 12 = 144$ sq. in. 1 sq. foot. = 144 sq. in.

3. Draw a square on the floor 1 yard long and 1 yard wide. This square has an area equal to a *square yard.* How many square feet are there in a square yard?



3 ft. = 1 yd.

4. Measure the length and width of the cover of this book and find its area.

5. Measure the length and width of your class room and find its area.

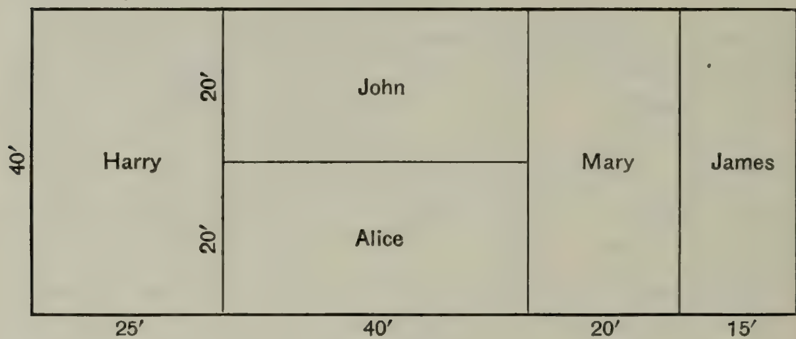
6. 2 sq. ft. = —— sq. in.	**9.** $\frac{1}{2}$ sq. ft. = —— sq. in.
7. 3 sq. yd. = —— sq. ft.	**10.** 72 sq. in. = —— sq. ft.
8. 27 sq. ft. = —— sq. yd.	**11.** 6 sq. ft. = —— sq. yd.

Find the areas of the following rectangles:

12. 6 ft. by 8 ft.	**15.** 10 in. by 12 in.
13. 7 yd. by 9 yd.	**16.** 15 ft. by 25 ft.
14. 4 yd. by 6 yd.	**17.** 35 yd. by 18 yd.

PROBLEMS ABOUT A SCHOOL GARDEN

Five of the pupils in Miss Adams' class have a school garden. The plan below shows how the land was divided among them.



1. How wide is the garden?

2. How long is the garden?

3. What is the area of the whole garden?

4. Who has the larger garden, Alice or Harry? how much larger?

5. What are the dimensions of John's garden patch? Mary's? James'?

6. Find the area of John's patch; Mary's; James'.

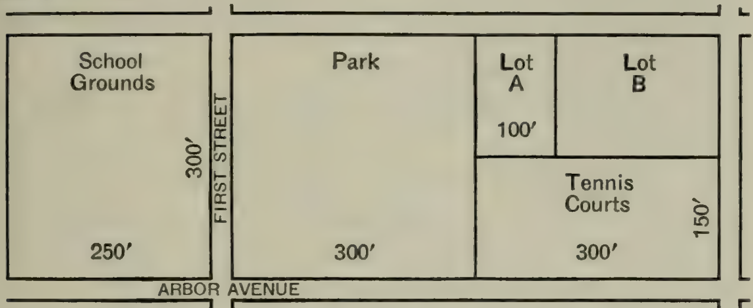
7. Find the total area of the garden by adding the sum of the areas of each of the parts. Is the sum of the areas the same as your answer to problem **3**?

***8.** Draw a plan of the garden in such a way that each of the pupils will have the same amount of land.

***9.** What is the perimeter of the school garden? Use the plan above to find out.

MEASURING AREAS

This is a map of part of the two blocks near which Harry lives.



1. How long is the block in which the park is? How wide is it?

2. What is the distance around the park?

3. What is the distance around the school grounds?

4. What is the area of the school grounds?

5. How much larger than the school grounds is the park?

6. What is the area of the block in which the park is located?

7. What are the dimensions of lot *A*? lot *B*?

8. Which has the larger area, lot *A* or lot *B*? how much larger?

9. Lot *B* sold for $1,500. How much was this a square foot?

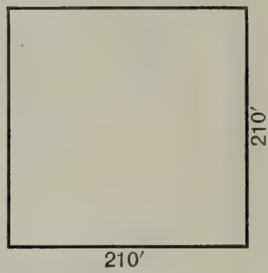
10. Are the school grounds more or less than an acre, and how much? (An acre = 43,560 square feet.)

*11. What is the area of your school grounds?

*12. What is the area of the piece of land on which your house is built?

MEASURING LARGER AREAS

The field on which the boys of the school play baseball is a square lot 210 feet on a side.



1. How many 2-foot steps must you take to walk around the field?

2. How many yards is it around the field?

3. This field is a little more than an *acre* in size. An acre contains 43,560 square feet. How much larger than an acre is the baseball field?

4. A more accurate measure of an acre is a piece of land 10 rods by 16 rods. How many square rods are there in an acre? $10 \times 16 = ?$ sq. rd.

5. Measure off a piece of land near the school which is an acre in size. Could it be a piece 4 rods by 40 rods?

6. A piece of land 1 mile square is called a *section.* It contains 640 acres. How large is a half section? a quarter section?

7. The average Kentucky farm is 79 acres. Is this about $\frac{1}{4}$, $\frac{1}{2}$, or $\frac{1}{8}$ of a section?

8. The average Iowa farm is 157 acres. Is this about $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$, or 2 sections?

9. The average Nevada farm is 745 acres. How much more than a section is this?

Table of Square Measure

144 sq. in. = 1 sq. ft.	160 sq. rd. = 1 acre
9 sq. ft. = 1 sq. yd.	640 a. = 1 section
$30\frac{1}{4}$ sq. yd. = 1 sq. rd.	1 sq. mi. = 1 section

10. Which unit of surface measure would you use to express the following:

a. The area of a small farm?

b. The area of the floor of a dining room?

c. The area of a state?

d. The area of a sidewalk?

11. The area of a floor 14 feet by 12 feet is 168 square ——.

12. The area of a field 10 rods by 12 rods is 120 square ——.

13. The area of a ranch 4 miles by 8 miles is 32 square ——.

14. 36 square feet = —— sq. yd.

15. 1,728 square inches = —— sq. yd.

16. 2 sections = —— acres.

17. Which has the greater area, a room 12 feet by 14 feet, or a room 13 feet by 13 feet?

***18.** Look up the areas of some of our national parks.

***19.** In your geography book you will find the area of the state in which you live. How is its area expressed?

TESTING WHAT YOU HAVE LEARNED

This exercise will show how well you remember what you have learned about fractions.

First find the sums of these numbers. Then find their differences.

1. $\frac{1}{2}$ $\frac{1}{2}$	**4.** 1 $\frac{1}{2}$	**7.** $9\frac{1}{4}$ 3	**10.** $2\frac{1}{4}$ $1\frac{1}{4}$	**13.** $12\frac{5}{6}$ $4\frac{1}{6}$	**16.** 9 $2\frac{3}{4}$
2. $\frac{3}{4}$ $\frac{3}{4}$	**5.** $\frac{5}{6}$ $\frac{1}{4}$	**8.** $\frac{3}{4}$ $\frac{1}{2}$	**11.** $\frac{7}{8}$ $\frac{3}{10}$	**14.** $\frac{4}{5}$ $\frac{2}{3}$	**17.** $6\frac{1}{2}$ $5\frac{1}{3}$
3. $9\frac{2}{5}$ $6\frac{1}{5}$	**6.** $11\frac{3}{4}$ $9\frac{2}{3}$	**9.** $12\frac{1}{2}$ $8\frac{1}{5}$	**12.** $9\frac{1}{5}$ $6\frac{3}{10}$	**15.** $7\frac{5}{6}$ $5\frac{7}{8}$	**18.** $9\frac{1}{4}$ $3\frac{5}{6}$

ZERO DIFFICULTIES IN SUBTRACTION OF FRACTIONS

1. Mary had $1\frac{3}{4}$ yards of lace. She used $1\frac{1}{2}$ yards of it for the border of a tablecloth. How much lace did she then have left?

$1\frac{3}{4} = 1\frac{3}{4}$ $1\frac{1}{2} = 1\frac{2}{4}$ $\frac{1}{4}$	Think: $1\frac{3}{4}$ yd. $-$ $1\frac{1}{2}$ yd. = ? Change $\frac{1}{2}$ to $\frac{2}{4}$. Subtract $\frac{2}{4}$ from $\frac{3}{4}$. Then subtract 1 from 1. Do not write the 0. Mary had $\frac{1}{4}$ yd. of lace left.

2. Study the following examples carefully. Show that the work in each is correct.

a.	*b.*	*c.*	*d.*	*e.*	*f.*
$5\frac{1}{4}$	$9\frac{5}{8}$	$\frac{1}{8}$	$8\frac{1}{2}$	$5\frac{1}{8}$	1
$2\frac{1}{4}$	$8\frac{7}{8}$	$\frac{1}{8}$	8	$5\frac{1}{8}$	$\frac{3}{4}$
3	$\frac{6}{8} = \frac{3}{4}$	0	$\frac{1}{2}$	0	$\frac{1}{4}$

3. Harry can run 50 yards in $8\frac{2}{5}$ seconds. John can run 50 yards in $9\frac{1}{5}$ seconds. In how much less time than John can Harry run 50 yards?

Find the answers to the following subtraction examples.

	a	*b*	*c*	*d*	*e*	*f*	*g*
4.	9 $1\frac{1}{3}$	$8\frac{3}{10}$ $7\frac{1}{2}$	$5\frac{1}{4}$ $5\frac{1}{4}$	8 $7\frac{1}{4}$	$4\frac{5}{6}$ $\frac{1}{3}$	$4\frac{2}{3}$ $\frac{2}{3}$	$12\frac{1}{2}$ 12
5.	$\frac{1}{4}$ $\frac{2}{8}$	$\frac{1}{5}$ $\frac{1}{5}$	$6\frac{1}{4}$ $2\frac{1}{4}$	1 $\frac{7}{8}$	$2\frac{1}{2}$ $2\frac{1}{4}$	$1\frac{1}{6}$ $\frac{2}{3}$	$9\frac{1}{4}$ $8\frac{3}{4}$
6.	$5\frac{1}{2}$ 5	$1\frac{1}{2}$ $\frac{5}{6}$	$7\frac{1}{3}$ $6\frac{5}{6}$	$1\frac{1}{10}$ $\frac{4}{5}$	$7\frac{1}{2}$ $6\frac{3}{4}$	$8\frac{1}{9}$ $\frac{1}{9}$	$7\frac{5}{6}$ $7\frac{1}{2}$
7.	15 $14\frac{2}{3}$	$3\frac{7}{8}$ $\frac{1}{4}$	8 $\frac{1}{5}$	$3\frac{1}{4}$ $2\frac{5}{8}$	$7\frac{3}{3}$ 3	$5\frac{1}{2}$ $4\frac{1}{2}$	$12\frac{9}{10}$ 12

A COMPLETION TEST

In each of the following sentences there is a word missing. Be ready to give the missing word.

1. In an addition example the answer is called the ——.
2. In a subtraction example the answer is called the ——.
3. In a multiplication example the answer is called the ——.
4. In a division example the answer is called the ——.
5. 57 is called a —— number.
6. $7\frac{1}{4}$ is called a —— number.
7. $\frac{4}{5}$ is called a —— fraction.
8. $\frac{9}{4}$ is called an —— fraction.
9. $\frac{5}{6}$ is reduced to —— terms.
10. Changing $\frac{3}{4}$ to $\frac{6}{8}$ is changing $\frac{3}{4}$ to —— terms.
11. $\frac{3}{4}$ is —— than $\frac{1}{2}$.
12. $\frac{2}{3}$ is —— than $\frac{5}{6}$.
13. In the fraction $\frac{5}{8}$, 5 is the —— of the fraction.
14. In the fraction $\frac{7}{8}$, 8 is the —— of the fraction.

PRACTICE IN CHANGING FRACTIONS

This exercise will help you in changing fractions to higher or lower terms. Supply the numbers that are missing.

1. $\frac{1}{2} = \frac{2}{4} = \frac{\quad}{8} = \frac{\quad}{16} = \frac{\quad}{32} = \frac{\quad}{12} = \frac{\quad}{10}$
2. $\frac{1}{4} = \frac{\quad}{8} = \frac{\quad}{16} = \frac{\quad}{12} = \frac{\quad}{24} = \frac{\quad}{20} = \frac{\quad}{28}$
3. $\frac{1}{3} = \frac{2}{\quad} = \frac{4}{\quad} = \frac{3}{\quad} = \frac{5}{\quad} = \frac{7}{\quad}$
4. $\frac{1}{5} = \frac{\quad}{10} = \frac{3}{\quad} = \frac{5}{\quad} = \frac{\quad}{20} = \frac{\quad}{30}$
5. $\frac{3}{4} = \frac{\quad}{16} = \frac{\quad}{8} = \frac{\quad}{12} = \frac{\quad}{20} = \frac{\quad}{32}$
6. $\frac{3}{8} = \frac{\quad}{16} = \frac{\quad}{24} = \frac{\quad}{32} = \frac{\quad}{40}$

SOLVING PROBLEMS BY USE OF DIAGRAMS

In solving a problem a diagram is often helpful. If you cannot see the diagram in your mind, draw one on paper.

1. In an orchard there are 4 rows of trees and 7 trees in each row. Make a diagram showing how many trees there are in the orchard.

2. Jack has a stamp book. On each page he has 24 stamps arranged in rows. Draw a page showing how Jack might have arranged his stamps. How many rows of stamps might he have on a page? how many stamps in each row?

3. Mrs. Smith cut a pie into 4 equal parts. Draw a picture of the pie. Show how it was cut.

4. Draw a pie divided into 8 equal pieces. What part of the pie is each of the 8 equal pieces? Color three of the eight parts. What part of the pie is not colored?

5. To go to his school, Harry walks east 2 blocks and north 4 blocks. Make a diagram of the route Harry takes to school.

6. Draw a picture of a thermometer. Mark on it zero, the freezing point of water, and the temperature at which your schoolroom should be kept.

7. Draw a face of a clock showing the hours with Roman numerals. Make the hands of the clock show 15 minutes past 5.

8. Draw a circle. Divide it into 4 equal parts. Color $\frac{3}{4}$ of it red.

9. Draw a rectangle whose dimensions are $2\frac{1}{2}$ inches by $1\frac{1}{4}$ inches. Find the perimeter of the rectangle.

COMPARING THE AREAS OF STATES

Large numbers are used often in geography. The following problems will give you practice in using large numbers.

State	Area (sq. mi.)	Inhabitants to a sq. mi.
Alabama	51,279	46
Arizona	113,810	3
California	155,652	22
Connecticut	4,820	286
Illinois	56,043	116
Massachusetts	8,039	479
Rhode Island	1,067	566
Texas	262,398	18

1. Which state has the largest area?

2. Which state has the largest number of inhabitants a square mile? the smallest number?

3. How much larger is the area of Texas than the area of Massachusetts? Connecticut? Rhode Island?

4. Is California more than half as large as Texas?

5. Is the area of Texas about 3, 5, 7, or 10 times that of Alabama?

6. Is Texas about 2, 5, 8, or 12 times as large as Illinois?

7. Find the population of Rhode Island by multiplying the area by the number of inhabitants a square mile.

8. Look up the exact population of Rhode Island in your geography. Was your answer to problem **7** almost correct?

9. Remember that there are 640 acres in a square mile. How many acres is that for a person in Arizona? in Texas?

***10.** In which of the states in the table would you expect to find the largest farms?

***11.** If you do not live in Texas, how much less than the area of Texas is the area of your home state?

A TRUE-FALSE TEST

Some of the following statements are true and some are false. Number lines on your paper from 1 to 20. If the statement is true, write *true* after the number of the statement; and if the statement is false, write *false*.

1. $\frac{1}{2}$ is a mixed number.

2. $\frac{7}{9}$ is reduced to lowest terms.

3. To find the difference between two numbers, multiply them.

4. To find how many times one number is contained in another, divide the larger by the smaller.

5. The perimeter of a rectangle is equal to twice its length.

6. A square is not a rectangle.

7. $\frac{4}{4}$ equals 1.

8. The area of a rectangle equals its length times its width.

9. The area of a square 4 feet on a side is 16 square yards.

10. $7\frac{1}{2}$ is an improper fraction.

11. $\frac{1}{2}$ plus $\frac{1}{4}$ equals $\frac{2}{6}$.

12. 8 minus $1\frac{1}{3}$ equals $7\frac{2}{3}$.

13. $\frac{12}{5}$ equals $2\frac{2}{5}$.

14. An article is always sold for more than it costs.

15. There are 60 seconds in a minute.

16. There are 8 pecks in a bushel.

17. There are 4 quarts in a gallon.

18. There are 12 ounces in a pound.

19. In the fraction $\frac{4}{5}$, 4 is called the denominator.

20. $2\frac{1}{8}$ equals $1\frac{9}{8}$.

USING FRACTIONS IN THE HOME

1. Mary made $2\frac{1}{2}$ pounds of chocolate fudge and $2\frac{3}{4}$ pounds of walnut fudge. How many pounds of fudge did she make?

2. Helen cut a piece of cloth $\frac{3}{8}$ of a yard long from a piece $1\frac{1}{4}$ yards long. What was the length of the piece remaining?

3. Mrs. Smith bought $2\frac{1}{2}$ pounds of meat on Monday, $3\frac{1}{4}$ pounds on Tuesday, and $2\frac{3}{4}$ pounds on Wednesday. How much meat did she buy?

4. Mary's mother bought $5\frac{1}{4}$ pounds of butter from the dairyman. She used $\frac{1}{8}$ of a pound for a cake and $\frac{1}{16}$ of a pound for cookies. How much butter did she then have?

5. Helen needed $3\frac{1}{4}$ yards of cloth for a dress. She had only $1\frac{7}{8}$ yards. How much more must she buy?

6. Harry's father drove the new automobile $21\frac{1}{2}$ miles the first day, $18\frac{4}{5}$ miles the second day, and $26\frac{3}{10}$ miles the third day. How far did he drive the car in the three days?

7. Mrs. Smith cut two apple pies into sixths. If 8 pieces were used for dinner, what part of a pie was left?

8. Henry caught a fish that weighed $3\frac{5}{8}$ pounds. Helen caught one that weighed $2\frac{13}{16}$ pounds. How much more than Helen's did Henry's fish weigh?

9. Margaret picked $7\frac{1}{2}$ dozen asters. She gave $2\frac{1}{2}$ dozen to her sick chum, Alice, and 3 dozen to the librarian. How many dozen asters did she then have?

10. Helen practiced on the piano $\frac{1}{2}$ hour on Monday, 1 hour on Tuesday, $\frac{5}{6}$ hour on Wednesday, and $\frac{3}{4}$ hour on Thursday. How many hours did she practice in all?

PROBLEM SCALE III

Standards	
Excellent	9 or 10 correct
Good	7 or 8 correct
Fair	5 or 6 correct
Unsatisfactory	0 to 4 correct

1. Alice has \$3.15 in her bank and Helen has \$4.20 in her bank. How much more than Alice has Helen in her bank?

2. Henry has 2 quarters and a dime. How many cents has he?

3. Arthur paid a dollar for 25 apples. What was the cost of one apple?

4. Margaret is $53\frac{1}{2}$ inches tall. How much more than 4 feet is this?

5. In a school auditorium there are 1,250 seats. There are 50 seats in each row. How many rows of seats are there in all?

6. Alice weighs $87\frac{1}{4}$ pounds and Mary weighs $95\frac{1}{8}$ pounds. How much less than Mary does Alice weigh?

7. Mr. Smith bought three loads of coal, one weighing $1\frac{3}{8}$ tons, one weighing $1\frac{3}{4}$ tons, and one weighing $1\frac{1}{2}$ tons. What was the weight of the three loads of coal?

8. Arthur bought 15 balloons for 75 cents and sold them for 10 cents each. How much more than he paid did he receive for all of the balloons?

9. One day Cecilia practiced her piano lesson for $\frac{1}{2}$ hour in the morning and for $\frac{3}{4}$ hour in the afternoon. How much longer than an hour did she practice in all?

10. John gathered $7\frac{1}{2}$ bushels of walnuts. He gave $2\frac{1}{2}$ bushels to his cousin, Ned. John sold the walnuts he had left at \$1.25 a bushel. What did he receive for the nuts that he sold?

CHAPTER IV

MULTIPLYING FRACTIONS AND WHOLE NUMBERS

1. Harry had three balls each of which weighed $\frac{2}{5}$ of a pound. What did the three balls weigh?

$3 \times \frac{2}{5} = \frac{6}{5}$ $\frac{6}{5} = 1\frac{1}{5}$	Think: $3 \times \frac{2}{5}$ lb. = ? 3×2 fifths is 6 fifths. $\frac{6}{5} = 1\frac{1}{5}$. The three balls weighed $1\frac{1}{5}$ lb.

2. Eggs weigh on the average about $\frac{1}{8}$ of a pound each. Find the weight of 10 eggs.

$10 \times \frac{1}{8} = \frac{10}{8}$. $\frac{10}{8} = 1\frac{2}{8} = 1\frac{1}{4}$	Think: $10 \times \frac{1}{8}$ lb. = ? lb. 10×1 eighth is 10 eighths. Ten eggs weigh about $1\frac{1}{4}$ lb.

Study the following examples until you understand how each one is worked.

3. $6 \times \frac{1}{5} = \frac{6}{5} = 1\frac{1}{5}$. **4.** $6 \times \frac{3}{4} = \frac{18}{4} = 4\frac{2}{4} = 4\frac{1}{2}$.

5. Copy examples **1** to **4** and work them with your book closed.

6. How many minutes are there in $\frac{3}{4}$ hour?

$\frac{3}{4} \times 60 = \frac{180}{4}$ $\frac{180}{4} = 45$	Think: $\frac{3}{4}$ of 60 minutes = ? minutes. "$\frac{3}{4}$ of" means the same as "$\frac{3}{4}$ times" or "$\frac{3}{4}\times$." $\frac{3}{4}$ of 60 is the same as $\frac{3}{4} \times 60$. $\frac{3}{4}$ hr. equals 45 min.

7. How many minutes are there in $\frac{1}{2}$ hour? in $\frac{2}{5}$ hour?

$\frac{1}{2}$ of $60 = \frac{1}{2} \times 60 = \frac{60}{2} = 30.$ $\frac{1}{2}$ hr. = 30 min.	$\frac{2}{5}$ of $60 = \frac{2}{5} \times 60 = \frac{120}{5} = 24.$ $\frac{2}{5}$ hr. = 24 min.

To multiply a fraction by a whole number, or a whole number by a fraction, multiply the numerator and the whole number, and divide the product by the denominator.

Multiply:

	a	*b*	*c*	*d*
8.	$6 \times \frac{4}{5} =$	$7 \times \frac{2}{3} =$	$9 \times \frac{3}{8} =$	$4 \times \frac{1}{5} =$
9.	$\frac{2}{3} \times 8 =$	$\frac{4}{9} \times 8 =$	$\frac{1}{6} \times 5 =$	$\frac{2}{3}$ of $15 =$
10.	$8 \times \frac{5}{6} =$	$6 \times \frac{2}{3} =$	$\frac{1}{4} \times 4 =$	$\frac{2}{5} \times 10 =$
11.	$7 \times \frac{3}{5} =$	$\frac{5}{9} \times 24 =$	$\frac{3}{8}$ of $40 =$	$32 \times \frac{7}{8} =$

12. At 36¢ a pound, what will $\frac{1}{2}$ pound of meat cost? $\frac{1}{4}$ pound? $\frac{3}{4}$ pound? $\frac{7}{8}$ pound?

A MULTIPLICATION TABLE FOR FRACTIONS

1. Write a multiplication table for $\frac{3}{4}$ like the one shown below for $\frac{2}{3}$. Reduce all products to lowest terms.

$1 \times \frac{2}{3} = \frac{2}{3}$	$\frac{2}{3} \times 1 = \frac{2}{3}$
$2 \times \frac{2}{3} = \frac{4}{3} = 1\frac{1}{3}$	$\frac{2}{3} \times 2 = \frac{4}{3} = 1\frac{1}{3}$
$3 \times \frac{2}{3} = \frac{6}{3} = 2$	$\frac{2}{3} \times 3 = \frac{6}{3} = 2$
$4 \times \frac{2}{3} = \frac{8}{3} = 2\frac{2}{3}$	$\frac{2}{3} \times 4 = \frac{8}{3} = 2\frac{2}{3}$
$5 \times \frac{2}{3} = \frac{10}{3} = 3\frac{1}{3}$	$\frac{2}{3} \times 5 = \frac{10}{3} = 3\frac{1}{3}$
$6 \times \frac{2}{3} = \frac{12}{3} = 4$	$\frac{2}{3} \times 6 = \frac{12}{3} = 4$
$7 \times \frac{2}{3} = \frac{14}{3} = 4\frac{2}{3}$	$\frac{2}{3} \times 7 = \frac{14}{3} = 4\frac{2}{3}$
$8 \times \frac{2}{3} = \frac{16}{3} = 5\frac{1}{3}$	$\frac{2}{3} \times 8 = \frac{16}{3} = 5\frac{1}{3}$
$9 \times \frac{2}{3} = \frac{18}{3} = 6$	$\frac{2}{3} \times 9 = \frac{18}{3} = 6$

2. Write multiplication tables for:

$\frac{5}{8}$, $\frac{1}{3}$, $\frac{5}{6}$, $\frac{2}{5}$, $\frac{1}{4}$, $\frac{7}{8}$, $\frac{3}{4}$, $\frac{5}{12}$, $\frac{7}{16}$, $\frac{1}{8}$.

TABLES FOR COOKING FOODS

This table is part of one that tells Mary's mother how long certain foods should cook.

Beets	**$\frac{3}{4}$ hour**	**Tomatoes**	**$\frac{1}{4}$ hour**
Spinach	**$\frac{1}{2}$ hour**	**Rice**	**$\frac{1}{3}$ hour**
Cabbage	**$\frac{1}{2}$ hour**	**Peas**	**$\frac{2}{3}$ hour**

1. Change the fractions of hours in this table to minutes.

2. Which vegetable cooks most rapidly? Which takes the longest time? What is the difference in the cooking time of these vegetables?

3. In her mother's cookbook Mary found the time it takes to bake certain foods.

White loaf bread	**50 minutes**	**Gingerbread**	**25 minutes**
Biscuits	**15 minutes**	**Cookies**	**10 minutes**
Muffins (raised)	**30 minutes**	**Pies**	**45 minutes**

Make a time-table for these foods showing the fraction of an hour each must be cooked.

4. What fraction of an hour longer than to bake cookies does it take to bake bread? biscuit? muffins? gingerbread? pies?

5. Mary put some beets on the stove to cook at 10:45. When will they be cooked?

6. Some biscuits were placed in the oven at 11:55. When will they be baked?

7. A pie was put into the oven at 11:25. When will it be baked?

8. Some cabbage was boiled for 50 minutes. How much longer than necessary was this?

***9.** Look in your mother's cookbook to see if the time given for cooking these foods is the same as in the tables.

A SALE

During a sale the following reductions were announced:

$\frac{1}{4}$ off on shoes	$\frac{1}{3}$ off on furniture
$\frac{1}{4}$ off on girls' hats	$\frac{1}{3}$ off on table linen
$\frac{1}{2}$ off on women's coats	$\frac{1}{2}$ off on boys' suits

Find the reduction and the sale price of each of the following articles:

1. A girl's hat, regularly priced at $4.80.

2. A boy's suit, regularly priced at $12.90.

3. A table, regularly priced at $12.75.

4. A pair of shoes, regularly priced at $3.60.

5. A tablecloth, regularly priced at $11.40.

6. A fur coat, regularly priced at $225.

7. Look in your daily papers for advertisements showing reductions of prices, such as $\frac{1}{2}$, $\frac{1}{3}$, and other similar amounts.

BUYING CANDY AT A SALE

1. At the school fair, May was selling candy. She was making a sign showing the prices of bags containing different amounts of candy. Find the numbers missing in the sign.

Prices	
Pound bag . . .	40¢
$\frac{1}{2}$ pound bag . .	?
$\frac{3}{4}$ pound bag . .	?
$\frac{1}{4}$ pound bag . .	?

2. What would $\frac{3}{4}$ pound of 50¢ candy cost? Count a fraction of a cent as a whole cent.

3. What would $\frac{1}{2}$ pound of 55¢ candy cost?

4. Arthur bought $\frac{1}{2}$ pound of 50¢ fudge and $\frac{3}{4}$ pound of 45¢ coconut candy. What did he pay for the candy?

5. Find the cost of $\frac{3}{4}$ pound of 60¢ candy; of $\frac{1}{2}$ pound of 75¢ candy.

MULTIPLICATION OF MIXED NUMBERS BY WHOLE NUMBERS

1. Harry bought $2\frac{3}{4}$ pounds of nuts at 24¢ a pound. What did the nuts cost him?

$2\frac{3}{4} \times 24¢ = ?$ 24 $2\frac{3}{4}$ 18 ($\frac{3}{4} \times 24$) 48 (2×24) 66¢	First find $\frac{3}{4}$ of 24¢ Then find $2 \times 24¢$. Add 18¢ and 48¢. The nuts cost him 66¢.

2. What would the nuts have cost at 32¢ a pound? at 40¢?

Find these products.

3. $15 \times 2\frac{1}{3}$
4. $6 \times 3\frac{1}{4}$
5. $21 \times 3\frac{3}{5}$
6. $4\frac{1}{2} \times 20$
7. $4\frac{3}{5} \times 12$
8. $15 \times 2\frac{3}{4}$
9. $5\frac{1}{4} \times 18$
10. $3\frac{5}{8} \times 20$
11. $24 \times 7\frac{1}{9}$
12. $36 \times 8\frac{7}{8}$
13. $5\frac{1}{2} \times 16$
14. $3\frac{1}{3} \times 15$

456 $32\frac{5}{6}$ 6)2,280 380 912 13 68 14,972	When more difficult numbers are to be multiplied, as $32\frac{5}{6} \times 456$, do the work as shown at the left. Multiply 456 by 5. This gives 2,280. Divide 2,280 by 6. This gives 380, which is $\frac{5}{6}$ of 456. Multiply 456 by 32. Notice how the numbers are placed. Add. The product is 14,972.

Find the products:

15. $792 \times 45\frac{3}{4}$
16. $864 \times 35\frac{7}{8}$
17. $495 \times 78\frac{3}{5}$
18. $463 \times 92\frac{2}{3}$
19. $765 \times 42\frac{5}{6}$
20. $857 \times 96\frac{9}{10}$

BUYING FOOD

Here are some prices that were printed on a handbill distributed by a grocer.

Coffee	**48¢ lb.**	**Oranges**	**40¢ doz.**
Butter	**52¢ lb.**	**Bread**	**11¢ loaf**
Eggs	**38¢ doz.**	**Potatoes**	**$1.78 bu.**
Apples	**50¢ pk.**	**Sugar**	**52¢ for 10 lb.**

Find the cost of the following supplies:

1. 5 loaves of bread.

2. $2\frac{1}{2}$ dozen eggs.

3. $\frac{1}{2}$ peck of apples.

4. $4\frac{1}{2}$ pounds of butter.

5. $\frac{3}{4}$ bushel of potatoes.

6. 20 pounds of sugar.

7. $1\frac{3}{4}$ pounds of coffee.

8. $3\frac{1}{2}$ dozen oranges.

9. What do 2 pounds of butter and $\frac{1}{2}$ dozen eggs cost?

10. How much would $1\frac{1}{2}$ pecks of apples, $\frac{1}{2}$ dozen eggs, and $\frac{1}{2}$ dozen oranges cost?

THE COST OF GASOLINE

1. Mary's father says that the cost of gasoline a mile for his automobile is $1\frac{3}{4}$¢. How much does the gasoline cost that is used on a 40-mile ride?

2. Arthur says that the cost of gasoline for his automobile is $1\frac{7}{8}$¢ a mile. How much more a mile is this than Mary's father pays for gasoline?

3. What does Arthur pay for gasoline for a 40-mile ride?

4. On a 40-mile trip Arthur's father used 60¢ worth of gasoline. What was the cost of the gasoline a mile?

5. What do $6\frac{1}{2}$ gallons of gasoline cost at 21 cents a gallon?

6. If Arthur's father paid $2.85 for 15 gallons of gasoline, what was the price a gallon?

AN IMPORTANT USE OF FRACTIONS

Mary bought 12 ounces of walnuts. How much did she pay if walnuts are 40¢ a pound?

> Think: 12 oz. is $\frac{12}{16}$ or $\frac{3}{4}$ lb.
> $\frac{3}{4}$ of 40¢ = 30¢.

1. Find the cost of 8 ounces of cheese if the price a pound is 42¢.

2. Mr. Smith bought a steak. It weighed 1 pound 6 ounces. The price was 48¢ a pound. How much did he pay for the steak?

> Think: 1 lb. 6 oz. is $1\frac{6}{16}$ lb. or $1\frac{3}{8}$ lb.
> 1 lb. 6 oz. will cost $1\frac{3}{8} \times$ 48¢ = ?

3. What will 1 pound 10 ounces of steak cost at 48¢ a pound?

4. Mary wanted 4 cookies for her lunch. If cookies are priced at 25¢ a dozen, what did she pay for them?

The baker, however, charged Mary 9¢ for the cookies. Stores usually count a fraction of a cent as a cent.

5. At 25¢ a dozen, what will 8 cookies cost? What will 6 cookies cost?

6. Find the cost of;

a. 18 apples at 20¢ a dozen.

b. 6 ounces of cheese at 40¢ a pound.

c. 2 pounds 5 ounces of loin of pork at 32¢ a pound.

d. 9 oranges at 45¢ a dozen.

e. 1 pound 2 ounces of grapes at 24¢ a pound.

f. 8 apples at 25¢ a dozen.

MIXED DRILL

Give the answers to the following examples. Use a pencil at first if necessary.

1. $29 + 12 =$

2. $89 - 21 =$

3. $\$.72 \div 9 =$

4. $\begin{array}{r} \$1.62 \\ \underline{+.44} \end{array}$

5. $\begin{array}{r} \$1.32 \\ \underline{-.89} \end{array}$

6. $12 \times 8 =$

7. $96 - 89 =$

8. $\begin{array}{r} \$.24 \\ \underline{\times 7} \end{array}$

9. $48 + 75 =$

10. $\begin{array}{r} \$3.00 \\ \underline{\times 6} \end{array}$

11 $82 - 28 =$

12. $336 \div 8 =$

13. $9\overline{)810}$

14. $9 + 8 + 7 =$

15. $196 \div 2 =$

16. $45 \times 4 =$

17. $7\overline{)532}$

18. $3 + 5 + 5 =$

19. $\begin{array}{r} 169 \\ \underline{-93} \end{array}$

20. $\begin{array}{r} 49 \\ \underline{+37} \end{array}$

21. $38 + 47 =$

22. $360 \div 6 =$

23. $\begin{array}{r} 156 \\ \underline{-58} \end{array}$

24. $5\overline{)435}$

25. $\begin{array}{r} \$.56 \\ \underline{+.48} \end{array}$

26. $5 \times 74 =$

27. $91 - 55 =$

28. $3\overline{)291}$

29. $42 \times 8 =$

30. $59 \times 7 =$

31. $74 - 63 =$

32. $4\overline{)272}$

33. $9 \times 5 =$

34. $\begin{array}{r} \$.48 \\ \underline{\times 9} \end{array}$

35. $\begin{array}{r} 47 \\ \underline{\times 9} \end{array}$

36. $5 + 8 + 6 =$

37. $6\overline{)480}$

38. $\begin{array}{r} 110 \\ \underline{-36} \end{array}$

39. $30 + 68 =$

40. $\begin{array}{r} 60 \\ \underline{\times 8} \end{array}$

41. $\$1.65 - \$.48 =$

42. $29 + 46 =$

43. $9\overline{)972} =$

44. $92 - 44 =$

45. $\$4.64 \div 8 =$

PROBLEMS ABOUT GARDENS

Harry, John, and Peter had small gardens in which they raised potatoes and other vegetables for sale. This table shows what each boy sold.

	Bushels of		Cash Sales of	
	Potatoes	Tomatoes	Lettuce	Carrots
Harry............	$4\frac{1}{2}$	$2\frac{1}{4}$	\$4.25	\$1.75
John.............	$2\frac{3}{4}$	4	\$1.75	\$ .90
Peter............	$5\frac{1}{4}$	$3\frac{1}{2}$	\$2.15	\$ .50

1. The potatoes were sold for \$1.80 a bushel.
What did Harry receive for his potatoes? John? Peter?

2. The tomatoes sold for \$.60 a bushel.
What did Harry receive for his tomatoes? John? Peter?

3. What did Harry receive for his potatoes, tomatoes, lettuce, and carrots?

4. What did John receive for the vegetables he sold?

5. What did Peter receive for the vegetables he sold?

6. Who received the largest amount of money? How much more than the amount John received was this?

7. How many bushels of potatoes more than John did Harry raise?

8. How many bushels of tomatoes less than John did Harry raise?

9. How many bushels of potatoes were raised by all of the boys? how many bushels of tomatoes?

10. Harry's father received \$426.75 for 569 bushels of potatoes. What was he paid a bushel?

A CAUTION

Three things that boys and girls often forget to do in working with fractions are:

a. *To reduce all fractions in answers to lowest terms.*

b. *To reduce all improper fractions to whole numbers or to mixed numbers expressed in lowest terms.*

c. *To reduce mixed numbers to simplest form.*

Reduce the following fractions to lowest terms where this has not already been done:

1. $\frac{3}{6}$, $\frac{9}{12}$, $\frac{8}{11}$
2. $\frac{12}{16}$, $\frac{4}{8}$, $\frac{5}{15}$
3. $\frac{9}{27}$, $\frac{8}{15}$, $\frac{3}{9}$
4. $\frac{4}{6}$, $\frac{5}{7}$, $\frac{12}{14}$
5. $\frac{11}{12}$, $\frac{9}{15}$, $\frac{7}{21}$
6. $\frac{16}{24}$, $\frac{17}{21}$, $\frac{18}{30}$
7. $\frac{12}{18}$, $\frac{10}{20}$, $\frac{8}{16}$
8. $\frac{15}{21}$, $\frac{18}{24}$, $\frac{16}{32}$
9. $\frac{17}{25}$, $\frac{18}{29}$, $\frac{16}{25}$
10. $\frac{12}{20}$, $\frac{15}{27}$, $\frac{24}{30}$
11. $\frac{36}{45}$, $\frac{18}{27}$, $\frac{26}{32}$
12. $\frac{40}{64}$, $\frac{42}{47}$, $\frac{28}{64}$

Reduce these improper fractions to whole or mixed numbers. Reduce all answers to lowest terms:

13. $\frac{12}{9}$, $\frac{18}{16}$, $\frac{15}{4}$
14. $\frac{9}{3}$, $\frac{18}{5}$, $\frac{16}{6}$
15. $\frac{18}{8}$, $\frac{19}{3}$, $\frac{15}{5}$
16. $\frac{17}{9}$, $\frac{18}{4}$, $\frac{16}{3}$
17. $\frac{24}{6}$, $\frac{18}{2}$, $\frac{27}{6}$
18. $\frac{21}{7}$, $\frac{63}{12}$, $\frac{48}{15}$
19. $\frac{39}{12}$, $\frac{70}{20}$, $\frac{80}{10}$
20. $\frac{65}{15}$, $\frac{48}{32}$, $\frac{96}{48}$
21. $\frac{37}{25}$, $\frac{66}{11}$, $\frac{84}{16}$

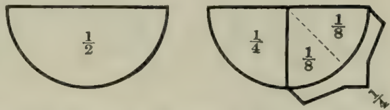
Reduce these mixed numbers to their simplest forms:

22. $8\frac{9}{6} =$
23. $9\frac{8}{3} =$
24. $6\frac{15}{5} =$
25. $9\frac{3}{2} =$
26. $8\frac{4}{4} =$
27. $9\frac{6}{6} =$
28. $8\frac{20}{5} =$
29. $4\frac{4}{2} =$
30. $16\frac{7}{3}$
31. $15\frac{12}{8}$
32. $17\frac{2}{2}$
33. $18\frac{6}{3}$

Find the answers to the following:

34. $\frac{7}{8} + \frac{7}{8} + \frac{3}{8} =$
35. $\frac{3}{4} + 1\frac{3}{4} + \frac{1}{4} =$
36. $\frac{1}{4} + \frac{1}{2} + \frac{1}{4} =$
37. $8\frac{1}{2} - 8\frac{1}{6} =$
38. $8\frac{3}{4} - 7\frac{1}{4} =$
39. $\frac{1}{6} \times 8 =$
40. $2\frac{1}{8} \times 12 =$
41. $1\frac{1}{6} \times 10 =$
42. $9\frac{1}{2} - 8\frac{5}{6} =$
43. $4\frac{5}{6} \times 93 =$
44. $15 \times \frac{3}{4} =$
45. $18 \times \frac{7}{8} =$

MULTIPLYING FRACTIONS BY FRACTIONS



1. Here are two half circles. Notice that $\frac{1}{4}$ circle is $\frac{1}{2}$ of a half circle. $\frac{1}{2}$ of $\frac{1}{2} = ?$

We can write this example in another way because in working with fractions "of" is written $\times$.

$$\boxed{\tfrac{1}{2} \text{ of } \tfrac{1}{2} = \tfrac{1}{2} \times \tfrac{1}{2} = ?}$$

2. Notice that $\frac{1}{2}$ of $\frac{1}{4}$ circle $= \frac{1}{8}$ circle

$$\boxed{\tfrac{1}{2} \text{ of } \tfrac{1}{4} = \tfrac{1}{2} \times \tfrac{1}{4} = ?}$$

To multiply two fractions, write the product of the numerators as the numerator of the answer, and the product of the denominators as the denominator of the answer.

3. $\frac{2}{3} \times \frac{4}{5} = \dfrac{2 \times 4}{3 \times 5} = ?$ **4.** $\frac{1}{4} \times \frac{1}{3} = \dfrac{1 \times 1}{4 \times 3} = ?$

Find the products of these fractions:

	a	*b*	*c*	*d*
5.	$\frac{1}{4} \times \frac{1}{2} =$	$\frac{1}{2} \times \frac{1}{3} =$	$\frac{1}{8} \times \frac{3}{4} =$	$\frac{1}{3} \times \frac{1}{2} =$
6.	$\frac{4}{5} \times \frac{2}{3} =$	$\frac{3}{4} \times \frac{5}{8} =$	$\frac{1}{4} \times \frac{3}{4} =$	$\frac{4}{5} \times \frac{2}{3} =$

7. Find the product of $\frac{4}{5} \times \frac{5}{6}$.

$$\boxed{\tfrac{4}{5} \times \tfrac{5}{6} = \dfrac{4 \times 5}{5 \times 6} = \dfrac{20}{30} = \tfrac{2}{3}}$$

Find the products of these fractions. Reduce all answers to lowest terms.

	a	*b*	*c*	*d*
8.	$\frac{3}{4} \times \frac{8}{9} =$	$\frac{8}{9} \times \frac{3}{4} =$	$\frac{7}{8} \times \frac{16}{21} =$	$\frac{4}{9} \times \frac{15}{16} =$
9.	$\frac{2}{3} \times \frac{3}{4} =$	$\frac{1}{2} \times \frac{6}{7} =$	$\frac{9}{10} \times \frac{20}{21} =$	$\frac{8}{9} \times \frac{15}{16} =$
10.	$\frac{1}{2} \times \frac{4}{5} =$	$\frac{3}{5} \times \frac{5}{6} =$	$\frac{11}{12} \times \frac{6}{7} =$	$\frac{5}{8} \times \frac{16}{25} =$

ON A DAIRY FARM

Ethel's father, Mr. Morton, bought a dairy farm. Here are some of the problems he had to work in buying the farm and in deciding what he would raise on it the first year.

1. There were 120 acres in the farm. Forty acres of it cost \$120 an acre, and the remaining 80 acres cost \$210 an acre. What did Mr. Morton pay for the farm?

2. Mr. Morton bought 15 dairy cows. For three Holstein cows he paid \$540, and for the rest an average of \$125 a cow. What did he pay in all for the cows?

3. For pasture Mr. Morton allowed $\frac{3}{4}$ acre for each cow. How many acres did he need for pasture in all?

4. For hay he allowed $1\frac{1}{4}$ acres for each cow. How many acres did he allow for hay?

5. For silage he allowed $1\frac{1}{8}$ acres for each cow. How much did he allow for silage?

6. He planted $\frac{3}{4}$ acre of oats for each cow. How many acres were needed to produce the oats for the cows?

7. He planted $\frac{7}{8}$ acre of barley for each cow. How many acres of barley did he plant?

8. How many acres did he use in all for pasture, hay, silage, oats, and barley?

9. An acre will produce about $2\frac{1}{2}$ tons of hay. How much hay will be produced by a 10-acre field?

10. How many acres were needed to provide pasture, hay, silage, oats, and barley for one cow?

CANCELLATION

A short-cut method, called *cancellation*, is often used in multiplying fractions.

Multiply $\frac{9}{10}$ by $\frac{8}{15}$

First solution:	*Second solution* (by cancellation):
$\frac{9}{10} \times \frac{8}{15} = \frac{72}{150}$ Reduce $\frac{72}{150}$ to lowest terms. $2 \mid \frac{72}{150} = \frac{36}{75}$ $3 \mid \frac{36}{75} = \frac{12}{25}$	$\frac{\overset{3}{\cancel{9}}}{\underset{5}{\cancel{10}}} \times \frac{\overset{4}{\cancel{8}}}{\underset{5}{\cancel{15}}} = \frac{12}{25}$ (In cancellation we divide before we multiply the terms of the fractions.) Questions: *a.* By what number were 8 and 10 divided? *b.* By what number were 9 and 15 divided? *c.* How was 12 found? *d.* How was 25 found?

1. Which of the following denominators can be cancelled with the numerator of the first fraction? Show how.

$\frac{3}{4} \times \frac{}{3}, \frac{}{6}, \frac{}{9}, \frac{}{8}, \frac{}{15}, \frac{}{10}$

2. In the following, indicate what numerators can be cancelled with the denominator of the first fraction. What would the numerators be after cancelling?

$\frac{3}{4} \times \frac{2}{}, \frac{4}{}, \frac{6}{}, \frac{8}{}, \frac{10}{}, \frac{9}{}$

Copy the following and cancel where possible.

3. $\frac{3}{} \times \frac{}{6}$ **6.** $\frac{9}{} \times \frac{}{15}$ **9.** $\frac{12}{} \times \frac{}{30}$ **12.** $\frac{}{4} \times \frac{14}{}$

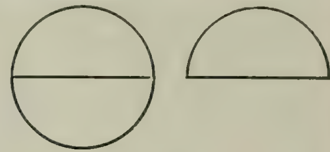
4. $\frac{1}{} \times \frac{}{8}$ **7.** $\frac{}{5} \times \frac{10}{}$ **10.** $\frac{}{9} \times \frac{6}{}$ **13.** $\frac{14}{} \times \frac{}{21}$

5. $\frac{6}{} \times \frac{}{10}$ **8.** $\frac{8}{} \times \frac{}{12}$ **11.** $\frac{10}{} \times \frac{}{12}$ **14.** $\frac{}{15} \times \frac{18}{}$

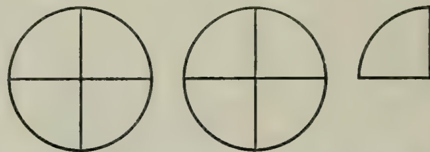
Find the products. Use cancellation.

	a	*b*	*c*	*d*
15.	$\frac{7}{8} \times \frac{1}{5} =$	$\frac{7}{12} \times \frac{9}{14} =$	$\frac{2}{3} \times \frac{9}{10} =$	$\frac{9}{15} \times \frac{35}{36} =$
16.	$\frac{9}{10} \times \frac{5}{6} =$	$\frac{8}{15} \times \frac{10}{11} =$	$\frac{1}{5} \times \frac{5}{6} =$	$\frac{12}{25} \times \frac{15}{16} =$
17.	$\frac{9}{16} \times \frac{8}{9} =$	$\frac{9}{14} \times \frac{7}{12} =$	$\frac{7}{9} \times \frac{15}{14} =$	$\frac{14}{25} \times \frac{6}{7} =$

REDUCING MIXED NUMBERS TO IMPROPER FRACTIONS



1. Use these circles to show that $1\frac{1}{2}$ circles are $\frac{3}{2}$ circles. $1 + \frac{1}{2} = \frac{?}{2}$



2. Show that $2\frac{1}{4}$ circles are $\frac{9}{4}$ circles. $2\frac{1}{4} = \frac{?}{4}$

Think: 2 wholes $= \frac{8}{4}$
$2\frac{1}{4} = \frac{8}{4} + \frac{1}{4} = \frac{9}{4}$

3. How many pieces of ribbon $\frac{1}{2}$ yard long can be cut from a piece $1\frac{1}{2}$ yards long? $2\frac{1}{2}$ yards long? $3\frac{1}{2}$ yards long?

> Think: In 1 yd. there are 2 half-yards.
> $1\frac{1}{2}$ yd. $= \frac{2}{2}$ yd. $+ \frac{1}{2}$ yd. $= \frac{3}{2}$ yd.
> $2\frac{1}{2}$ yd. $= \frac{4}{2}$ yd. $+ \frac{1}{2}$ yd. $= \frac{5}{2}$ yd.
> $3\frac{1}{2}$ yd. $= \frac{6}{2}$ yd. $+ \frac{1}{2}$ yd. $= \frac{7}{2}$ yd.

To reduce any mixed number to an improper fraction, first multiply the integer of the mixed number by the denominator of the fraction. Then add to this product the numerator of the fractional part. Write this sum over the denominator.

4. $5\frac{1}{2} = \frac{?}{2}$	**6.** $6\frac{1}{4} = \frac{}{4}$	**8.** $3\frac{1}{3} = \frac{}{3}$	**10.** $7\frac{1}{6} = \frac{}{6}$
5. $4\frac{2}{3} = \frac{?}{3}$	**7.** $3\frac{1}{5} = \frac{}{5}$	**9.** $1\frac{1}{8} = \frac{}{8}$	**11.** $5\frac{1}{7} = \frac{}{7}$

Change these mixed numbers to improper fractions:

12. $2\frac{1}{2}$, $1\frac{1}{4}$, $4\frac{1}{3}$	**14.** $1\frac{4}{5}$, $2\frac{3}{4}$, $6\frac{2}{3}$	**16.** $8\frac{3}{4}$, $7\frac{2}{3}$, $6\frac{7}{9}$
13. $4\frac{1}{5}$, $1\frac{1}{3}$, $5\frac{1}{6}$	**15.** $7\frac{7}{8}$, $4\frac{5}{6}$, $3\frac{3}{5}$	**17.** $11\frac{1}{2}$, $8\frac{3}{4}$, $7\frac{9}{10}$

18. Show by a drawing that $2\frac{1}{2}$ circles are equal to $\frac{5}{2}$ circles.

19. Show on a ruler that $2\frac{1}{8}$ in. $= \frac{17}{8}$ in.; $3\frac{1}{2}$ in $= \frac{7}{2}$ in.; $6\frac{1}{4}$ in. $= \frac{25}{4}$ in.

MULTIPLYING MIXED NUMBERS

1. Harry can pick about $2\frac{1}{2}$ bushels of apples an hour. How many bushels can he pick in $3\frac{1}{2}$ hours?

$3\frac{1}{2} \times 2\frac{1}{2}$ bu. = ? bu. $\frac{7}{2} \times \frac{5}{2} = \frac{35}{4} = 8\frac{3}{4}$	Change the mixed numbers to improper fractions. Multiply as in multiplying fractions. Reduce the answer to lowest terms.

2. Jack can pick $3\frac{3}{4}$ bushels of apples an hour. How many bushels can he pick in $3\frac{1}{2}$ hours?

	a	*b*	*c*
3.	$2\frac{1}{2} \times 3\frac{1}{4} =$	$6\frac{2}{3} \times 2\frac{2}{5} =$	$4\frac{3}{4} \times 2\frac{2}{3} =$
4.	$1\frac{1}{2} \times 2\frac{1}{3} =$	$7\frac{1}{2} \times 1\frac{1}{3} =$	$6\frac{1}{4} \times 2\frac{4}{5} =$
5.	$4\frac{1}{2} \times 2\frac{2}{3} =$	$2\frac{1}{2} \times 2\frac{1}{3} =$	$5\frac{3}{5} \times 2\frac{1}{7} =$
6.	$\frac{1}{2} \times \frac{1}{4} =$	$\frac{1}{2}$ of $12 =$	$9 \times 16\frac{2}{3} =$
7.	$\frac{2}{3} \times \frac{7}{8} =$	$\frac{2}{3} \times 2 =$	$\frac{3}{8} \times 2 =$
8.	$\frac{8}{9} \times \frac{3}{4} =$	$5 \times 2\frac{1}{2} =$	$\frac{1}{6}$ of $4 =$
9.	$8\frac{2}{3} + 4\frac{1}{2} =$	$6\frac{1}{2} + 8\frac{3}{4} =$	$\frac{5}{6} + 1\frac{3}{8} =$
10.	$12 - 11\frac{7}{8} =$	$6\frac{1}{3} - 4\frac{1}{2} =$	$8\frac{1}{2} - 2\frac{7}{8} =$

PRACTICING WHAT YOU HAVE LEARNED

Find the answers in the following examples:

	a	*b*	*c*
1.	$\frac{1}{2} + \frac{1}{4} =$	$\frac{1}{2} - \frac{1}{4} =$	$4 \times \frac{1}{6} =$
2.	$9\frac{1}{4} + \frac{1}{4} =$	$3\frac{1}{2} - 2 =$	$\frac{2}{3} \times 5 =$
3.	$3\frac{5}{8} + \frac{7}{8} =$	$14 - 3\frac{1}{3} =$	$7 \times 2\frac{1}{2} =$
4.	$4\frac{4}{5} + 6\frac{3}{5} =$	$\frac{1}{3} - \frac{1}{5} =$	$3\frac{1}{3} \times 4\frac{1}{5} =$
5.	$7\frac{1}{3} + 2\frac{1}{2} =$	$\frac{3}{4} - \frac{5}{8} =$	$\frac{3}{4} \times \frac{1}{5} =$
6.	$6\frac{7}{8} + 5\frac{1}{4} =$	$9\frac{1}{3} - 4\frac{1}{6} =$	$6 \times 5\frac{1}{3} =$
7.	$5 + 2\frac{3}{4} =$	$7\frac{3}{4} - 2\frac{7}{8} =$	$4\frac{1}{5} \times \frac{5}{7} =$
8.	$4 + \frac{1}{6} =$	$4\frac{2}{5} - 1\frac{1}{2} =$	$6\frac{1}{4} \times 6 =$

HOW HARRY EARNED MONEY

Harry worked at the corner grocery after school each day and on Saturdays. He was paid 20 cents an hour for his work. He kept a careful record of the time he worked. Here is part of his record.

Day	Week of May 6	Week of May 13	Week of May 20
Monday..........	$1\frac{1}{2}$ hr.	$1\frac{1}{4}$ hr.	$1\frac{1}{2}$ hr.
Tuesday..........	$1\frac{1}{2}$ hr.	$1\frac{1}{2}$ hr.	$1\frac{1}{4}$ hr.
Wednesday.......	$\frac{3}{4}$ hr.	$1\frac{1}{4}$ hr.	$2\frac{1}{4}$ hr.
Thursday.........	$2\frac{1}{2}$ hr.	$\frac{3}{4}$ hr.	0
Friday	2 hr.	$\frac{1}{2}$ hr.	$2\frac{1}{2}$ hr.
	?	?	?

1. How many hours did he work during the week of May 6? of May 13? of May 20?

2. How many hours did he work in all during the three weeks?

3. What did he earn during the first week?

4. How much more did he earn during the week of May 6 than during the week of May 13?

5. How much did he earn during the third week?

6. How much did he earn in all?

7. Make a neat copy of the form of the table that Harry used. Do not write in the number of hours as they are given in the table. Instead, write the amount Harry earned each day. Do your work carefully.

8. Find the amount Harry earned each week.

9. From this table find the total amount that Harry earned. Is your answer the same as the answer for problem **8**? Should it be?

MORE CANCELLATION

Cancellation can be used in working examples like the following:

$6 \times \frac{7}{8} =$ $\frac{\cancel{6}^{3}}{1} \times \frac{7}{\cancel{8}_{4}} = \frac{21}{4} = 5\frac{1}{4}$ What is the divisor of 6 and 8? How was $\frac{21}{4}$ found? How was $5\frac{1}{4}$ found?	$4\frac{1}{2} \times 1\frac{1}{3} =$ $\frac{\cancel{9}^{3}}{\cancel{2}_{1}} \times \frac{\cancel{4}^{2}}{\cancel{3}_{1}} = \frac{6}{1} = 6$ How was $\frac{9}{2}$ found? $\frac{4}{3}$? What is the divisor of 9 and 3? of 2 and 4? How was 6 found?	$8\frac{1}{4} \times \frac{1}{11} \times \frac{4}{5} =$ $\frac{\cancel{33}^{3}}{\cancel{4}_{1}} \times \frac{1}{\cancel{11}_{1}} \times \frac{\cancel{4}^{1}}{5} = \frac{3}{5}$ How was $\frac{33}{4}$ found? What is the divisor of 33 and 11? How was $\frac{3}{5}$ found?

Find the products. Use cancellation.

1. $6 \times \frac{9}{10} =$	8. $10\frac{1}{2} \times \frac{4}{9} =$	15. $6 \times \frac{1}{2} \times \frac{7}{8} =$
2. $8 \times \frac{3}{4} =$	9. $9\frac{1}{5} \times 3\frac{3}{4} =$	16. $3\frac{1}{2} \times 10 \times \frac{1}{7} =$
3. $\frac{4}{5} \times 10 =$	10. $\frac{8}{15} \times \frac{25}{32} =$	17. $9\frac{3}{8} \times 1\frac{3}{5} \times 4 =$
4. $3\frac{1}{3} \times 4\frac{1}{5} =$	11. $8 \times \frac{9}{14} =$	18. $\frac{15}{24} \times \frac{6}{5} \times \frac{2}{3} =$
5. $2\frac{1}{2} \times 1\frac{1}{3} =$	12. $\frac{8}{15} \times 6 =$	19. $\frac{21}{25} \times 1\frac{3}{7} \times \frac{1}{4} =$
6. $6\frac{1}{4} \times 2\frac{1}{5} =$	13. $7\frac{1}{2} \times 3\frac{3}{5} =$	20. $4\frac{1}{6} \times \frac{7}{15} \times \frac{3}{7} =$
7. $9\frac{1}{3} \times \frac{1}{7} =$	14. $\frac{8}{9} \times \frac{9}{10} =$	21. $9\frac{1}{6} \times \frac{6}{11} \times \frac{1}{5} =$

WATCHING 1'S IN MULTIPLICATION

$\frac{7}{8} \times \frac{4}{7} = ?$ $\frac{\cancel{7}^{1}}{\cancel{8}_{2}} \times \frac{\cancel{4}^{1}}{\cancel{7}_{1}} = \frac{1 \times 1}{2 \times 1} = \frac{1}{2}$	Watch the 1's in this example. Show that the work is correct.

Work these examples. Watch the 1's.

1. $\frac{3}{5} \times 1\frac{2}{3} =$	4. $\frac{1}{4} \times \frac{4}{5} =$	7. $2\frac{2}{3} \times \frac{1}{8} =$
2. $1\frac{1}{2} \times \frac{2}{3} =$	5. $\frac{5}{6} \times \frac{1}{5} =$	8. $3\frac{1}{3} \times \frac{1}{10} =$
3. $1\frac{1}{8} \times \frac{4}{9} =$	6. $\frac{3}{4} \times \frac{4}{9} =$	9. $\frac{2}{3} \times \frac{3}{4} =$

HOW JOHN EARNED MONEY

John advertised in the newspaper that he would cut lawns for 30¢ an hour. Soon he had several lawns to cut. He kept the record of his work shown at the right.

LAWN	TIME	COST
Mr. Jones	$2\frac{1}{2}$ hr.	?
Mr. Andrews	$3\frac{1}{4}$ hr.	?
Mr. Smith	$1\frac{3}{4}$ hr.	?
Mr. Block	2 hr.	?
Mr. Johnson	$4\frac{1}{2}$ hr.	?
TOTAL	?	?

1. What did John receive for cutting each lawn?

2. What did he earn in all?

3. How many hours did he work on the five lawns?

4. How much longer did it take to cut Johnson's lawn than to cut Smith's?

5. How much less time did it take to cut Block's lawn than to cut Andrews'?

6. It took him only 40 minutes to cut Coffman's lawn. What should he be paid at the rate of 30 cents an hour?

7. He cut the grass on Mr. Haggerty's lawn in an hour and 15 minutes. What should he receive at 30 cents an hour?

8. John began cutting Mrs. Morrel's lawn at 9:25 A. M. He finished the work at 10:55 A. M. What should he receive at 30 cents an hour?

9. During July and August, while the Bailey family were on their vacation, John took full charge of their lawn, flower beds, and garden. He received 40¢ an hour for $60\frac{3}{4}$ hours work in July and $50\frac{1}{2}$ hours work in August. How much did he earn in all?

CHANGING RECIPES

Mary found this recipe for making 8 cups of cocoa in her mother's cookbook:

8 cups of milk
8 teaspoons of cocoa
$\frac{1}{4}$ cup of sugar

As Mary wanted to make only 4 cups of cocoa, how much of each article did she use?

1. Find one-half of these recipes for fudge and walnut candy.

CHOCOLATE FUDGE
2 cups of sugar
$\frac{1}{4}$ cup of water
$\frac{3}{4}$ cup of milk
$\frac{1}{2}$ tablespoonful of butter
1 square of chocolate

WALNUT CANDY
4 cups of sugar
$\frac{2}{3}$ cup of milk
1 teaspoonful of vanilla
$\frac{3}{4}$ cup of walnuts

2. Double each of the recipes for walnut candy.

3. Double this recipe for whole-wheat bread.

2 cups scalded milk
$\frac{1}{4}$ cup of sugar
2 teaspoons of salt
1 yeast cake dissolved in
$\frac{1}{4}$ cup of lukewarm water
$4\frac{2}{3}$ cups of flour

4. Find one-half of this recipe for buns.

1 cup boiled milk
$\frac{1}{4}$ cup sugar
2 tablespoons butter
$\frac{3}{4}$ teaspoon salt
$\frac{1}{2}$ yeast cake dissolved in
$\frac{1}{4}$ cup of lukewarm water
$\frac{3}{4}$ teaspoon cinnamon
3 cups flour
1 egg
$\frac{1}{4}$ cup of raisins or
$\frac{1}{4}$ cup currants

5. Double this recipe for spice cake.

$\frac{2}{3}$ cup of butter
$\frac{3}{4}$ cup of sugar
2 eggs
$\frac{2}{3}$ cup milk
$\frac{1}{3}$ cup molasses
$2\frac{1}{3}$ cups flour
$\frac{3}{4}$ teaspoon soda
1 teaspoon cinnamon
$\frac{1}{2}$ teaspoon allspice
$\frac{1}{4}$ teaspoon cloves
$\frac{1}{2}$ cup raisins
$\frac{1}{3}$ cup of cut citron

A SUMMER CAMP

Each summer the Smith boys go to a summer camp on one of the lakes.

1. On the way to the camp they go through Standish, which is $12\frac{1}{4}$ miles from home. Standish is $5\frac{1}{2}$ miles from the camp. How far is the camp from their home?

2. The camp is $\frac{1}{8}$ mile from a mail box on the road. In going for the mail each morning and returning to camp, how far does Harry Smith have to walk?

3. One morning John Smith caught two bass. One of them weighed $1\frac{3}{4}$ pounds and the other weighed $1\frac{1}{8}$ pounds. What did the two fish weigh together?

4. The law requires that all perch less than $6\frac{1}{4}$ inches in length be thrown back into the lake. John caught one that was $6\frac{7}{8}$ inches long. How much over the legal limit was this?

5. John went to the grocery store to get $3\frac{1}{2}$ pounds of butter. Butter sold at 36¢ a pound. What did he pay for the butter?

6. On another day he bought 4 pounds of sugar at $7\frac{1}{2}$¢ a pound and 4 loaves of bread at 12¢ a loaf. What did these articles cost him? What change did he receive from a $1.00 bill?

7. The motor boat makes, on the average, $10\frac{1}{2}$ miles an hour. How far does it go in $\frac{3}{4}$ hour? in $1\frac{2}{3}$ hours?

8. It is $2\frac{3}{4}$ miles across the lake to the village of Dayton. The boat is halfway across. How much farther has it to go?

9. Mr. Johnson, director of the camp, estimated that the boys used $2\frac{1}{4}$ pounds of butter a day. How much would the butter for a week cost at $.40 a pound?

AN ARITHMETIC GAME

Work as many of these examples as you can in fifteen minutes. Copy the examples only when necessary.

1. $\begin{array}{r}16\\-7\\\hline\end{array}$	**7.** $\begin{array}{r}15\\+4\\\hline\end{array}$	**13.** $\begin{array}{r}4\\\times 8\\\hline\end{array}$	**19.** $3\overline{)96}$	**25.** $\begin{array}{r}32\\+6\\\hline\end{array}$
2. $\begin{array}{r}62\\\times 4\\\hline\end{array}$	**8.** $\begin{array}{r}19\\-6\\\hline\end{array}$	**14.** $4\overline{)68}$	**20.** $\begin{array}{r}35\\\times 5\\\hline\end{array}$	**26.** $\begin{array}{r}14\\+84\\\hline\end{array}$
3. $4\overline{)892}$	**9.** $\begin{array}{r}79\\-55\\\hline\end{array}$	**15.** $\begin{array}{r}619\\\times 3\\\hline\end{array}$	**21.** $\begin{array}{r}15\\+8\\\hline\end{array}$	**27.** $\begin{array}{r}23\\-6\\\hline\end{array}$
4. $6\overline{)972}$	**10.** $\begin{array}{r}90\\\times 8\\\hline\end{array}$	**16.** $\begin{array}{r}58\\+8\\\hline\end{array}$	**22.** $\begin{array}{r}92\\-38\\\hline\end{array}$	**28.** $9\overline{)963}$
5. $\begin{array}{r}17\\+58\\\hline\end{array}$	**11.** $\begin{array}{r}32\\\times 23\\\hline\end{array}$	**17.** $\begin{array}{r}976\\-328\\\hline\end{array}$	**23.** $\begin{array}{r}61\\17\\20\\\hline\end{array}$	**29.** $82\overline{)164}$
6. $\begin{array}{r}828\\-145\\\hline\end{array}$	**12.** $\begin{array}{r}34\\\times 76\\\hline\end{array}$	**18.** $89\overline{)356}$	**24.** $\begin{array}{r}430\\+375\\\hline\end{array}$	**30.** $\begin{array}{r}509\\\times 29\\\hline\end{array}$

FINDING THE COST OF FOODS

1. Harry's father eats two eggs for breakfast each morning. What do they cost at 30¢ a dozen? How many eggs does he eat in a week? What do they cost?

2. In March the price of eggs was 32¢ a dozen. How many eggs did Harry's father eat during the month? How much did the eggs cost?

3. In December the price was 50¢ a dozen. What was the total cost of the eggs which Harry's father ate for breakfast during the month?

4. The Boy Scout manual makes an estimate of $\frac{1}{25}$ of a pound of butter a meal for each person. If butter is 50¢ a pound, find the cost of butter for one meal for a group of 25 Boy Scouts.

5. About $\frac{3}{4}$ pound of flour is used for a one-pound loaf of bread. How many pounds of flour are used for a batch of 24 one-pound loaves? At $5\frac{1}{2}$¢ a pound, find the cost of the flour for the 24 loaves.

6. Henry fed his chickens 4 pounds of wheat a day. Find the cost of the wheat if the price a bushel of 60 pounds was $1.50.

7. A family of five used, on the average, $1\frac{3}{4}$ pounds of meat a day. Find the average cost a person if meat costs 36¢ a pound.

8. Mrs. Smith uses about $\frac{1}{2}$ pound of sugar a day. Find the cost of sugar for one week at $7\frac{1}{2}$¢ a pound.

9. Mrs. Smith used $\frac{3}{4}$ peck of potatoes a week. Find the cost of potatoes for 4 weeks at 60¢ a peck.

10. Find the cost of 6 bananas, if bananas are selling at 30 cents a dozen.

FINDING DIFFICULTIES IN MULTIPLYING FRACTIONS

Can you work all of these examples correctly? If you make mistakes, learn why. Use cancellation whenever possible. Be sure that all answers are reduced to lowest terms. Be sure to multiply correctly.

	a	*b*	*c*	*d*
1.	$\frac{1}{4} \times 8 =$	$\frac{1}{9}$ of $3 =$	$\frac{2}{5} \times 2 =$	$\frac{5}{6} \times 14 =$
2.	$2 \times \frac{4}{9} =$	$3 \times \frac{1}{3} =$	$4 \times \frac{1}{2} =$	$8 \times \frac{1}{6} =$
3.	$\frac{1}{4}$ of $\frac{1}{6} =$	$\frac{1}{4} \times \frac{8}{9} =$	$\frac{1}{2} \times \frac{7}{10} =$	$\frac{5}{8} \times \frac{16}{25} \times \frac{1}{2} =$
4.	$6 \times 2\frac{1}{3} =$	$7 \times 4\frac{1}{2} =$	$6 \times 3\frac{3}{4} =$	$6 \times 4\frac{3}{8} \times 2\frac{4}{5} =$
5.	$2\frac{1}{4} \times \frac{1}{4} =$	$3\frac{1}{5} \times 2 =$	$3\frac{1}{6} \times 4 =$	$5\frac{2}{3} \times 6 \times 2\frac{1}{3} =$
6.	$\frac{1}{4} \times 2\frac{1}{2} =$	$\frac{1}{2}$ of $1\frac{1}{5} =$	$\frac{5}{8} \times 6\frac{2}{5} =$	$\frac{2}{3} \times 4\frac{3}{4} \times \frac{2}{3} =$
7.	$3\frac{1}{3} \times \frac{2}{9} =$	$3\frac{1}{3} \times \frac{1}{8} =$	$7\frac{1}{2} \times \frac{2}{5} =$	$3\frac{1}{5} \times \frac{3}{8} \times \frac{8}{9} =$
8.	$2\frac{1}{2} \times 2\frac{1}{4} =$	$6\frac{1}{4} \times 6\frac{2}{5} =$	$3\frac{3}{4} \times 3\frac{1}{3} =$	$4\frac{3}{8} \times 2\frac{6}{7} \times 1\frac{4}{5} =$
9.	24 $\underline{3\frac{1}{8}}$	$36\frac{5}{6}$ $\underline{12}$	18 $\underline{15\frac{3}{4}}$	23 $\underline{18\frac{3}{5}}$

Practice these examples until you can work all of them correctly.

TEST ON MULTIPLICATION OF FRACTIONS

Find the products. Use cancellation. Reduce answers to lowest terms. If you can work all these examples correctly, you have learned to multiply fractions very well.

1. $\frac{1}{4} \times \frac{1}{4} =$	**4.** $\frac{1}{4} \times \frac{2}{3} =$	**7.** $\frac{1}{5} \times \frac{5}{12} =$	**10.** $6 \times \frac{7}{8} =$
2. $\frac{9}{10} \times 7 =$	**5.** $3\frac{1}{2} \times 4 =$	**8.** $6 \times 7\frac{1}{4} =$	**11.** $4\frac{1}{2} \times \frac{1}{3} =$
3. $\frac{3}{5} \times 8\frac{1}{3} =$	**6.** $6\frac{1}{4} \times 3\frac{1}{5} =$	**9.** $\frac{1}{8} \times 4\frac{2}{3} =$	**12.** $64 \times 7\frac{3}{4} =$

REVIEW OF IMPORTANT POINTS

This exercise will review the important points that you have learned.

1. Reduce the following to improper fractions:

$3\frac{1}{2}$ $4\frac{2}{3}$ $8\frac{7}{8}$ $5\frac{5}{6}$ $7\frac{3}{8}$ $6\frac{2}{5}$

2. Reduce the following to lowest terms:

$\frac{4}{12}$ $\frac{9}{21}$ $\frac{16}{28}$ $\frac{18}{27}$ $\frac{15}{42}$ $\frac{84}{120}$

3. $\frac{3}{5} \times \frac{8}{11} = \dfrac{3 \times ?}{5 \times ?} = ?$

4. Find the answers to the following examples:

$4 \times \frac{1}{8} =$ $4 \times \frac{5}{6} =$ $14 \times \frac{1}{2} =$

5. How can cancellation be used in finding the answers to the following examples?

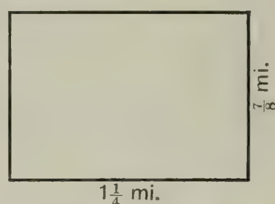
$\frac{6}{7} \times \frac{2}{3} =$ $\frac{9}{10} \times \frac{2}{3} =$ $\frac{4}{15} \times 10 =$

6. What is the easiest method of multiplying two small mixed numbers? for example, $1\frac{1}{2} \times 2\frac{2}{3} = ?$

7. Find the product of $3\frac{3}{4}$ and 128 in two ways.

8. Is this answer satisfactory? $12\frac{14}{35}$.

9. Find the area of this field.



10. If 640 acres equal 1 square mile, how many acres are there in the field in problem **9**?

11. Find the perimeter of the field in problem **9**.

12. Find the sum of $5\frac{1}{3}$, $6\frac{3}{4}$, and $7\frac{7}{8}$.

13. Change to simplest form: $7\frac{9}{2}$, $8\frac{15}{3}$, $6\frac{8}{6}$.

14. Subtract $4\frac{7}{8}$ from $5\frac{1}{2}$.

15. Supply the missing numbers: $5\frac{1}{2} = 4\frac{\ }{4}$, $8\frac{1}{3} = 7\frac{\ }{15}$.

16. Find the cost of 12 ounces of cheese at 40¢ a pound.

PROBLEMS OF THE HOME

1. Mr. Miller receives a salary of \$5,200 a year. How much is this a month? a week? (Count 52 weeks as a year.)

2. Last year he spent $\frac{3}{4}$ of his salary. How much money did he spend?

3. What part of his salary did he save? How much money was this?

4. One-fifth of what he spent was paid for rent. What fraction of his total salary was paid for rent? (Think: $\frac{1}{5}$ of $\frac{3}{4} = ?$)

5. Mr. Miller's grocery bills for three months were as follows: \$60.15, \$65.45, \$62.50. How much a month did they average?

6. At this average, what will the cost of groceries amount to in a year?

7. One day Mrs. Miller ordered two kinds of meat. The meat market sent her $3\frac{3}{4}$ pounds of beef and $2\frac{1}{2}$ pounds of pork. How many pounds of meat did Mrs. Miller buy that day?

8. At 35¢ a pound for the beef and 34¢ a pound for the pork, what did the meat cost?

9. Mrs. Miller decided to cook only about $\frac{3}{4}$ of the beef for dinner. How many pounds is $\frac{3}{4}$ of $3\frac{3}{4}$ pounds?

10. Mrs. Miller estimated that each member of the family ate about $\frac{1}{4}$ of a pound of meat a day. There were 6 in the family. How many pounds a day was this? What would the meat cost at an average price of 36¢ a pound?

11. What would the meat cost this family a year (365 days) at this rate?

PRACTICE TESTS IN THE FUNDAMENTALS

You should be able to work the examples in the following sets and to check your work in the time allowed. When necessary, copy the examples before counting time.

Addition Test (8 minutes)

1.	2.	3.	4.	5.	6.
768	478	669	533	562	169
880	307	430	576	619	202
909	724	388	785	516	122
710	430	599	266	441	473
781	839	580	759	375	534
905	599	607	248	148	357

Subtraction Test (5 minutes)

1.	3.	5.	7.	9.	11.
9,241	9,972	8,787	9,210	9,517	9,173
3,259	3,238	1,328	6,503	5,534	2,526

2.	4.	6.	8.	10.	12.
8,323	9,842	9,653	9,254	6,265	7,310
5,789	7,189	4,597	4,786	2,687	4,345

Multiplication Test (9 minutes)

1.	3.	5.	7.	9.	11.
348	463	278	914	641	167
27	84	93	65	39	72

2.	4.	6.	8.	10.	12.
187	375	592	529	826	365
48	56	702	408	650	930

Division Test (10 minutes)

1. $62\overline{)38,936}$ 3. $42\overline{)25,956}$ 5. $83\overline{)31,899}$ 7. $48\overline{)38,640}$

2. $53\overline{)39,379}$ 4. $29\overline{)24,650}$ 6. $46\overline{)37,747}$ 8. $56\overline{)392,280}$

Do special work on the processes in which your scores are lowest.

TEST IN ADDITION OF FRACTIONS

You should be able to work the examples in this test in addition of fractions in less than 12 minutes. Work carefully and do not hurry. Check your work.

1. $\frac{1}{4}$ $\frac{1}{4}$	**3.** 8 $\frac{3}{4}$	**5.** $\frac{4}{5}$ $\frac{3}{5}$	**7.** $\frac{1}{3}$ $\frac{1}{6}$	**9.** $\frac{3}{8}$ $\frac{5}{8}$ $\frac{1}{4}$	**11.** $6\frac{1}{5}$ $5\frac{4}{5}$
2. $\frac{1}{2}$ $\frac{3}{4}$ $\frac{3}{4}$	**4.** $\frac{3}{4}$ $1\frac{1}{4}$	**6.** $5\frac{1}{3}$ $3\frac{1}{4}$	**8.** $\frac{1}{2}$ $\frac{1}{4}$ $\frac{1}{8}$	**10.** $3\frac{1}{3}$ $2\frac{1}{3}$ $1\frac{1}{2}$	**12.** $5\frac{1}{8}$ $6\frac{1}{2}$ $8\frac{1}{3}$

TEST IN SUBTRACTION OF FRACTIONS

You should be able to work the examples in this test in subtraction of fractions in less than 12 minutes. Work carefully and do not hurry. Check your work.

1. $\frac{3}{4}$ $\frac{1}{4}$	**3.** $4\frac{1}{5}$ $2\frac{2}{5}$	**5.** $\frac{1}{4}$ $\frac{1}{5}$	**7.** $9\frac{1}{2}$ $3\frac{1}{4}$	**9.** $6\frac{5}{6}$ $4\frac{1}{6}$	**11.** $4\frac{7}{8}$ $\frac{1}{2}$
2. $8\frac{1}{4}$ $4\frac{1}{4}$	**4.** $14\frac{7}{8}$ $3\frac{1}{6}$	**6.** $9\frac{5}{8}$ $8\frac{7}{8}$	**8.** $6\frac{1}{4}$ $\frac{1}{2}$	**10.** $3\frac{1}{3}$ $\frac{5}{12}$	**12.** $8\frac{1}{2}$ $6\frac{3}{5}$

Repeat these tests until you can work all of the examples correctly in the time allowed. Ask your teacher for help on those that you find most difficult. Keep a record of your time and the number correct on three trials of each test on a form like the one below.

Trial	Time	Number Correct
1.........		
2.........		
3.........		

PROBLEM SCALE IV

Standards	
Excellent	9 or 10 correct
Good	7 or 8 correct
Fair.	5 or 6 correct
Unsatisfactory	0 to 4 correct

1. Helen wants to buy a $1.75 doll. She has only $1.46. How much more must she have before she can buy the doll?

2. How many pounds of butter does a family use in a year if 5 pounds are used each week?

3. Harry bought 12 quarts of berries at 15 cents a quart. He gave the grocer a $2 bill. What change did he receive?

4. The reading lesson in the fifth grade is 35 minutes long. How many minutes a week are spent on reading?

5. A farmer raised 657 bushels of potatoes on an 18-acre field. How many bushels of potatoes were raised, on the average, an acre?

6. Timothy hay seed costs $6 a bushel. One peck is needed an acre. Find the cost of the seed for 20 acres.

7. Mary's mother wished to divide 5 pounds of candy equally among four children. How much should each receive?

8. Mrs. Smith bought 3 bars of soap for 10 cents. What do 9 bars cost at the same rate?

9. Harry bought some apples for 20 cents and sold them for 25 cents. His profit on each apple was 1 cent. How many apples did he buy?

10. Mrs. Smith had three apples trees. One gave $6\frac{3}{4}$ bushels, one gave $10\frac{1}{4}$ bushels, and one gave $9\frac{1}{2}$ bushels. She sold all of the apples for $1.20 a bushel. What did she receive for them?

CHAPTER V

DIVIDING BY FRACTIONS

1. Mary had two pies cut into fourths. How many fourths did she have?

There are 4 fourths in one pie. There are 2×4 fourths or 8 fourths in two pies.

$$2 \div \tfrac{1}{4} = 2 \times 4 = ?$$

2. John feeds his chickens $\frac{1}{8}$ bushel of grain a week. How long will 3 bushels last?

There are 8 eighths of a bushel in a bushel. Therefore one bushel will last 8 weeks. 3 bushels will last 3×8 weeks or 24 weeks.

$$3 \div \tfrac{1}{8} = 3 \times 8 = ?$$

3. John's father feeds his horses $\frac{1}{4}$ bushel of oats each meal. How long will 5 bushels last? $5 \div \frac{1}{4} = 5 \times ? = ?$

In each of these examples the division sign was changed to a multiplication sign and the divisor was *inverted*; or, as Harry Andrews said, "The divisor is upside down."

The inverted form of $\frac{1}{4}$ is $\frac{4}{1}$ or 4, since 4 is 4 ones.

The inverted form of $\frac{1}{8}$ is $\frac{8}{1}$ or 8.

The inverted form of $\frac{1}{2}$ is $\frac{2}{1}$ or 2.

The inverted form of $\frac{2}{3}$ is $\frac{3}{2}$.

Give the inverted form of the following:

4. $\frac{1}{5}$; $\frac{1}{6}$; $\frac{1}{3}$; $\frac{4}{5}$; $\frac{3}{4}$; $\frac{2}{3}$; $\frac{6}{9}$; $\frac{5}{8}$; $\frac{1}{5}$; $\frac{2}{10}$.

5. $4 \div \frac{1}{5} = 4 \times$ the inverted form of $\frac{1}{5} = 4 \times ? = ?$

6. $3 \div \frac{2}{3} = 3 \times ? = ?$ **7.** $9 \div \frac{1}{5} = 9 \times ? = ?$

DIVIDING BY FRACTIONS

Dividing by fractions should be easy for you because you already know how to multiply fractions.

Study the following examples carefully.

$3 \div \frac{1}{4} =$ $3 \div \frac{1}{4} = 3 \times \frac{4}{1} = \frac{12}{1} = 12$	Step 1: Change the $\div$ sign to $\times$, and invert the divisor. Step 2: Multiply.
$5 \div \frac{2}{3} = ?$ $5 \div \frac{2}{3} = 5 \times \frac{3}{2} = \frac{15}{2} = 7\frac{1}{2}$	Explain each step in working this example.
$8 \div \frac{6}{7} = ?$ $8 \div \frac{6}{7} = \overset{4}{\cancel{8}} \times \frac{7}{\underset{3}{\cancel{6}}} = \frac{28}{3} = 9\frac{1}{3}$	Explain the two steps in this example. Notice that cancellation is used in working this example.

Supply the missing numbers in the following examples, then solve.

1. $9 \div \frac{3}{4} = 9 \times \frac{\ }{3} = ?$
2. $8 \div \frac{10}{11} = 8 \times \frac{\ }{10} = ?$
3. $5 \div \frac{3}{4} = 5 \times \frac{\ }{3} = ?$
4. $6 \div \frac{2}{3} = 6 \times \frac{\ }{2} = ?$
5. $7 \div \frac{4}{5} = 7 \times ? = ?$
6. $6 \div \frac{9}{10} = 6 \times ? = ?$
7. $12 \div \frac{15}{16} = 12 \times ? = ?$
8. $9 \div \frac{3}{4} = 9 \times ? = ?$

APPLYING DIVISION BY FRACTIONS

1. How many half inches are there in 4 inches? $4 \div \frac{1}{2} = ?$

2. How many quarter inches are there in 3 inches? $3 \div \frac{1}{4} = ?$

3. How many badges $\frac{1}{8}$ of a yard long can be cut from a ribbon 4 yards long? $4 \div \frac{1}{8} = ?$

4. Allowing $\frac{7}{8}$ of a yard for each towel, how many towels can be cut from 7 yards of toweling? $7 \div \frac{7}{8} = ?$

5. John cut a piece of wire 6 feet long into pieces $\frac{3}{4}$ foot long. How many pieces did he then have?

6. A large apple weighs about $\frac{3}{16}$ pound. About how many apples are there in a 6-pound bag of these apples?

Find the answers. Use cancellation whenever possible.

7. $2 \div \frac{1}{3} =$
8. $5 \div \frac{1}{2} =$
9. $4 \div \frac{2}{3} =$
10. $8 \div \frac{4}{5} =$
11. $12 \div \frac{3}{4} =$
12. $1 \div \frac{5}{8} =$
13. $10 \div \frac{4}{5} =$
14. $30 \div \frac{5}{12} =$
15. $7 \div \frac{3}{4} =$
16. $49 \div \frac{7}{8} =$
17. $40 \div \frac{5}{8} =$
18. $3 \div \frac{1}{2} =$
19. $1 \div \frac{3}{8} =$
20. $1 \div \frac{4}{5} =$
21. $15 \div \frac{9}{10} =$
22. $25 \div \frac{5}{6} =$
23. $20 \div \frac{3}{8} =$
24. $14 \div \frac{2}{5} =$

SOME THINGS TO DO

1. Draw a line 3 inches long. Measure off on it as many $\frac{1}{2}$ inches as you can. How many times is $\frac{1}{2}$ inch contained in 3 inches? $3 \div \frac{1}{2} = ?$

2. How many times is $\frac{1}{2}$ inch contained in 4 inches? $4 \div \frac{1}{2} = ?$ Check with a ruler.

3. Draw a line 6 inches long. Measure off as many parts each $\frac{3}{4}$ inch long as you can on this line. How many $\frac{3}{4}$ inches do you find? $6 \div \frac{3}{4} = ?$

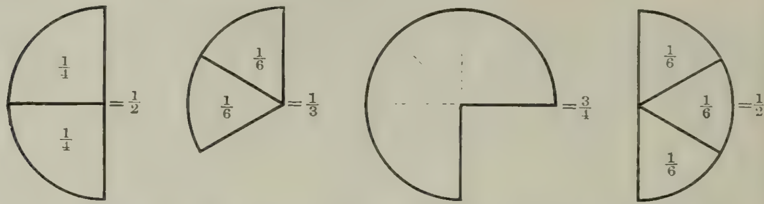
4. How many $\frac{3}{4}$ inches are there in 3 inches? Find this with a ruler. $3 \div \frac{3}{4} = ?$

Find the answers to the following examples, using the method you learned on page 156. Then use a ruler to show that your answers are correct.

5. $2 \div \frac{1}{2} =$
6. $1 \div \frac{1}{2} =$
7. $5 \div \frac{1}{2} =$
8. $4 \div \frac{2}{3} =$
9. $2 \div \frac{1}{4} =$
10. $2 \div \frac{1}{8} =$
11. $3 \div \frac{3}{8} =$
12. $4 \div \frac{4}{5} =$
13. $5 \div \frac{5}{8} =$
14. $2 \div \frac{2}{8} =$
15. $7 \div \frac{7}{8} =$
16. $4 \div \frac{8}{9} =$

DIVIDING A FRACTION BY A FRACTION

Find the answers to the first four examples by making use of these drawings.



1. How many times is $\frac{1}{4}$ contained in $\frac{1}{2}$? $\frac{1}{2} \div \frac{1}{4} = ?$
2. How many times is $\frac{1}{6}$ contained in $\frac{1}{3}$? $\frac{1}{3} \div \frac{1}{6} = ?$
3. $\frac{3}{4} \div \frac{1}{8} = ?$ **4.** $\frac{1}{2} \div \frac{1}{6} = ?$

By using the drawings you can see that $\frac{1}{2} \div \frac{1}{4} = 2$; that is, $\frac{1}{4}$ is contained in $\frac{1}{2}$ two times. This example can be worked without using the drawings.

Invert the divisor and multiply as you did in dividing a whole number by a fraction.

Study the work below carefully.

$\frac{1}{2} \div \frac{1}{4} = \frac{1}{\cancel{2}} \times \frac{\overset{2}{\cancel{4}}}{1} = 2$	$\frac{3}{4} \div \frac{1}{8} = \frac{3}{\cancel{4}} \times \frac{\overset{2}{\cancel{8}}}{1} = 6$
$\frac{1}{3} \div \frac{1}{6} = \frac{1}{\cancel{3}} \times \frac{\overset{2}{\cancel{6}}}{1} = 2$	$\frac{1}{2} \div \frac{1}{6} = \frac{1}{\cancel{2}} \times \frac{\overset{3}{\cancel{6}}}{1} = 3$

5. How many ribbons $\frac{1}{8}$ yard long can be cut from a ribbon $\frac{3}{4}$ yard long? $\frac{5}{8}$ yard long? $\frac{1}{2}$ yard long?

Find the quotients:

6. $\frac{1}{8} \div \frac{1}{2} =$	**11.** $\frac{2}{3} \div \frac{1}{6} =$	**16.** $\frac{6}{7} \div \frac{3}{4} =$
7. $\frac{1}{2} \div \frac{1}{6} =$	**12.** $\frac{3}{4} \div \frac{9}{10} =$	**17.** $\frac{9}{10} \div \frac{3}{5} =$
8. $\frac{1}{4} \div \frac{1}{6} =$	**13.** $\frac{2}{3} \div \frac{14}{15} =$	**18.** $\frac{5}{6} \div \frac{11}{12} =$
9. $\frac{1}{4} \div \frac{1}{2} =$	**14.** $\frac{3}{4} \div \frac{3}{4} =$	**19.** $\frac{6}{7} \div \frac{1}{2} =$
10. $\frac{1}{3} \div \frac{1}{6} =$	**15.** $\frac{7}{8} \div \frac{5}{8} =$	**20.** $\frac{9}{16} \div \frac{1}{2} =$

DIVIDING A WHOLE NUMBER BY A MIXED NUMBER

1. Find how many ribbons $1\frac{1}{2}$ feet long can be cut from a 6-foot ribbon.

$6 \div 1\frac{1}{2} = \frac{}{2}$ $6 \div \frac{3}{2} = \overset{2}{\cancel{6}} \times \frac{2}{\underset{1}{\cancel{3}}} = 4$	Change $1\frac{1}{2}$ to an improper fraction, and proceed as in dividing by a fraction.

In dividing by a mixed number, change the mixed number to an improper fraction, and proceed as in dividing by a fraction.

Study the following examples carefully.

$7 \div 2\frac{1}{2} =$ $7 \times \frac{2}{5} = \frac{14}{5} = 2\frac{4}{5}$	$5 \div 7\frac{1}{2} =$ $\overset{1}{\cancel{5}} \times \frac{2}{\underset{3}{\cancel{15}}} = \frac{2}{3}$

Change the following mixed numbers to improper fractions.

2. $1\frac{1}{2} = \frac{}{2}$ **3.** $4\frac{3}{4} = \frac{}{4}$ **4.** $3\frac{2}{3} = \frac{}{3}$ **5.** $4\frac{3}{5} = \frac{}{5}$

Find the answers.

	a	*b*	*c*	*d*
6.	$7 \div 4\frac{1}{2} =$	$6 \div 2\frac{2}{5} =$	$9 \div 4\frac{1}{5} =$	$14 \div 1\frac{1}{6} =$
7.	$8 \div 1\frac{3}{5} =$	$9 \div 4\frac{1}{4} =$	$8 \div 2\frac{2}{7} =$	$11 \div 16\frac{1}{2} =$
8.	$9 \div 7\frac{1}{2} =$	$8 \div 2\frac{3}{5} =$	$16 \div 6\frac{2}{5} =$	$4 \div 5\frac{2}{3} =$
9.	$4 \div 2\frac{2}{3} =$	$6 \div 1\frac{1}{7} =$	$5 \div 6\frac{2}{3} =$	$9 \div 11\frac{1}{4} =$

10. Find the number of shelves, each $1\frac{1}{2}$ feet long, that can be cut from a board 9 feet in length.

11. Find the number of fence posts $8\frac{1}{2}$ feet long that can be cut from a tree 34 feet long.

12. If $2\frac{1}{2}$ yards of cloth are needed for one dress, how many dresses can be made from 15 yards of cloth?

13. At $2\frac{1}{2}$¢ each, how many apples can you buy for 10¢? for 20¢? for 35¢? for 40¢? for 75¢?

JOHN'S PRIZE CORN PATCH

1. John had a piece of land 210 feet long and 210 feet wide. His father plowed it for him with a plow that made a furrow $1\frac{1}{6}$ feet wide. How many furrows did he make?

2. Allowing $3\frac{1}{2}$ feet for a row, how many rows of corn did he plant?

3. He planted his hills of corn in each row $2\frac{1}{2}$ feet apart. How many hills were there in each row? in his field?

4. Show that John's piece of land was about an acre in size. An acre equals 43,560 square feet.

5. John raised 84 bushels of corn on his patch. How many bushels did he raise on each row?

6. Corn on the ear weighs about 70 pounds a bushel. How many pounds of corn did John raise on each row?

7. John sold his corn for seed at $1.48 a bushel. What did he receive for his corn?

8. John's father raised 784 bushels of corn which he sold for $.97 a bushel. What did he receive for the corn?

DIVIDING A FRACTION BY A MIXED NUMBER

1. One and one-half cups of flour weigh about $\frac{3}{8}$ pound. Find the weight of one cup.

$\frac{3}{8}$ lb. $\div 1\frac{1}{2} = ?$ lb. $\frac{3}{8} \div 1\frac{1}{2} = \frac{3}{8} \div \frac{3}{2} = \frac{\overset{1}{\cancel{3}}}{\underset{4}{\cancel{8}}} \times \frac{\overset{1}{\cancel{2}}}{\underset{1}{\cancel{3}}} = \frac{1}{4}$ lb.	Change $1\frac{1}{2}$ to $\frac{3}{2}$. Proceed as in dividing by a fraction.

2. If $1\frac{1}{2}$ cups of sugar weigh $\frac{3}{4}$ pound, find the weight of a cup of sugar. Think: $\frac{3}{4}$ lb. $\div 1\frac{1}{2} = ?$ lb.

3. What is the inverted form of each of these numbers:

$\frac{1}{4}$? $3\frac{1}{2}$? $\frac{7}{8}$? $\frac{3}{5}$? $1\frac{1}{4}$? $2\frac{2}{3}$? $4\frac{5}{6}$? $\frac{9}{10}$?

Find the answers:

	a	*b*	*c*	*d*
4.	$\frac{1}{4} \div 1\frac{1}{3} =$	$\frac{2}{3} \div 1\frac{1}{7} =$	$\frac{5}{8} \div 2\frac{1}{7} =$	$\frac{4}{5} \div 5\frac{1}{3} =$
5.	$\frac{3}{4} \div 2\frac{1}{4} =$	$\frac{4}{5} \div 8\frac{1}{3} =$	$\frac{8}{9} \div 1\frac{1}{9} =$	$\frac{2}{3} \div 1\frac{1}{2} =$

SOME SPEED RECORDS

1. An arithmetic test of 20 examples was completed by each of six children in the following lengths of time:

John	**$2\frac{1}{2}$ min.**	**Mary**	**$5\frac{1}{2}$ min.**
Kate	**$2\frac{3}{4}$ min.**	**Jean**	**$3\frac{1}{3}$ min.**
Arthur	**3 min.**	**Carl**	**$7\frac{1}{2}$ min.**

Find the number of examples each child worked a minute.

2. How much longer than Kate did it take Carl?

3. The teacher gave the pupils a paragraph to read containing 525 words. This tells how long it took the same six children to read the paragraph:

John	**$1\frac{1}{2}$ min.**	**Mary**	**$5\frac{1}{4}$ min.**
Kate	**$2\frac{3}{4}$ min.**	**Jean**	**$6\frac{1}{4}$ min.**
Arthur	**$2\frac{1}{2}$ min.**	**Carl**	**$2\frac{3}{4}$ min.**

How many words a minute did each child read?

4. John can run 50 yards in $8\frac{1}{2}$ seconds. How many yards a second is this?

DIVIDING A MIXED NUMBER BY A FRACTION OR A MIXED NUMBER

1. How many half inches are there in $1\frac{1}{2}$ inches?

Think: $1\frac{1}{2}$ in. $\div$ $\frac{1}{2}$ in. = ? $1\frac{1}{2} \div \frac{1}{2} = \frac{3}{2} \div \frac{1}{2} = \frac{3}{2} \times \frac{2}{1} = ?$	Change $1\frac{1}{2}$ to $\frac{3}{2}$. Proceed as in dividing two fractions.

2. How many quarter inches are there in $3\frac{1}{4}$ inches?

Divide the following:

	a	*b*	*c*	*d*
3.	$7\frac{1}{2} \div \frac{1}{2} =$	$3\frac{1}{3} \div \frac{1}{6} =$	$5\frac{5}{8} \div \frac{3}{4} =$	$5\frac{1}{4} \div \frac{3}{4} =$
4.	$2\frac{1}{2} \div \frac{1}{2} =$	$2\frac{1}{4} \div \frac{1}{7} =$	$9\frac{2}{7} \div \frac{5}{9} =$	$3\frac{1}{6} \div \frac{2}{7} =$

5. How many pieces of ribbon $1\frac{1}{2}$ inches long can be cut from a ribbon $4\frac{1}{2}$ inches long?

Think: $4\frac{1}{2}$ in. $\div$ $1\frac{1}{2}$ in. = ? $4\frac{1}{2} \div 1\frac{1}{2} = \frac{9}{2} \div \frac{3}{2} = \frac{\cancel{9}^{3}}{\cancel{2}_{1}} \times \frac{\cancel{2}^{1}}{\cancel{3}_{1}} = \mathbf{3}$	Change both mixed numbers to improper fractions. Proceed as in dividing two fractions.

To divide a mixed number by a mixed number, change both to improper fractions and proceed as in the division of a fraction by a fraction.

6. How many $1\frac{1}{2}$-pound boxes of mints can be filled from $7\frac{1}{2}$ pounds? from 9 pounds?

Find the answers:

	a	*b*	*c*	*d*
7.	$6\frac{1}{2} \div 2\frac{1}{2} =$	$3\frac{1}{3} \div 1\frac{2}{3} =$	$1\frac{1}{4} \div 3\frac{1}{3} =$	$3\frac{1}{8} \div 1\frac{1}{9} =$
8.	$7\frac{1}{2} \div 2\frac{1}{2} =$	$4\frac{1}{4} \div 3\frac{1}{2} =$	$2\frac{2}{5} \div 6\frac{3}{4} =$	$5\frac{1}{7} \div 2\frac{2}{5} =$
9.	$12\frac{1}{2} \div 2\frac{1}{2} =$	$2\frac{1}{5} \div 4\frac{1}{3} =$	$3\frac{1}{7} \div 5\frac{1}{5} =$	$15\frac{1}{3} \div 1\frac{1}{6} =$
10.	$5\frac{1}{2} \div 1\frac{2}{9} =$	$4\frac{7}{8} \div \frac{3}{8} =$	$4\frac{1}{5} \div \frac{3}{5} =$	$6\frac{2}{3} \div \frac{1}{7} =$
11.	$7\frac{1}{2} \div 2\frac{1}{2} =$	$10 \div 3\frac{1}{3} =$	$\frac{1}{2} \div 3\frac{1}{4} =$	$8\frac{1}{2} \div \frac{1}{10} =$

USING WHAT YOU HAVE LEARNED

1. If Harry's steps average $2\frac{1}{2}$ feet, how many steps does he take in walking a mile?

2. A barrel holds $31\frac{1}{2}$ gallons. How many gallons will 6 barrels hold?

3. On a hike Harold walked 8 miles in $2\frac{1}{2}$ hours. How many miles did he walk in an hour?

4. How many minutes are there in $3\frac{1}{2}$ hours?

5. Jack can run 50 yards in $7\frac{1}{2}$ seconds. How many yards can he run in one second?

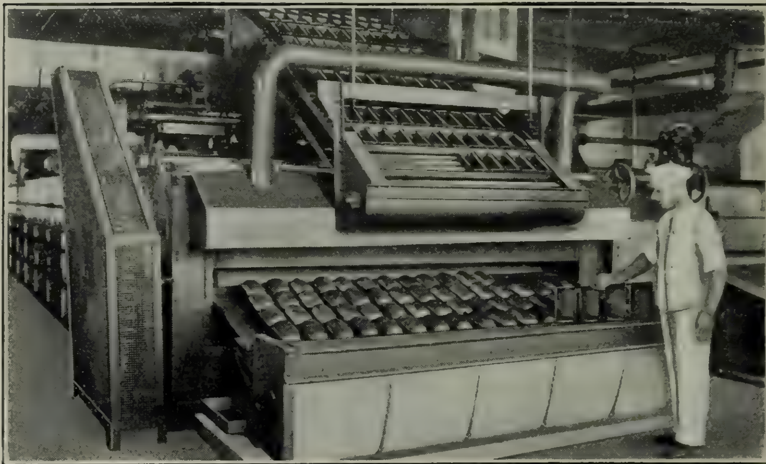
Find the answers to the following examples:

	a	*b*	*c*	*d*
6.	$9 \div \frac{3}{4} =$	$4 \div 5\frac{1}{3} =$	$7 \div 1\frac{3}{4} =$	$8 \times 4\frac{1}{2} =$
7.	$6 \div \frac{5}{8} =$	$\frac{1}{2} \div \frac{2}{3} =$	$\frac{3}{5} \div 1\frac{1}{5} =$	$25\frac{1}{4} - 16\frac{7}{8} =$
8.	$8 \div 1\frac{1}{2} =$	$8 \div \frac{1}{4} =$	$\frac{3}{4} \div \frac{7}{8} =$	$7\frac{5}{6} + 6\frac{2}{3} =$
9.	$\frac{1}{3} \div \frac{1}{6} =$	$\frac{1}{5} \div \frac{1}{5} =$	$\frac{9}{10} \div 2\frac{1}{4} =$	$3\frac{1}{3} \times 1\frac{1}{4} =$

PRACTICE IN DIVISION OF FRACTIONS

Find the quotients.

1. $3 \div \frac{1}{4} =$	**11.** $\frac{7}{8} \div \frac{3}{4} =$	**21.** $6 \div \frac{2}{3} =$
2. $8 \div 1\frac{1}{3} =$	**12.** $8 \div \frac{6}{7} =$	**22.** $4 \div \frac{4}{5} =$
3. $\frac{1}{4} \div \frac{1}{2} =$	**13.** $\frac{1}{5} \div 2\frac{1}{10} =$	**23.** $4\frac{2}{3} \div \frac{2}{9} =$
4. $\frac{1}{4} \div \frac{3}{3} =$	**14.** $\frac{1}{2} \div \frac{4}{5} =$	**24.** $\frac{2}{3} \div \frac{1}{6} =$
5. $9 \div \frac{15}{16} =$	**15.** $9 \div 11\frac{1}{2} =$	**25.** $8 \div \frac{9}{10} =$
6. $\frac{4}{9} \div \frac{2}{3} =$	**16.** $16\frac{2}{3} \div 5\frac{5}{9} =$	**26.** $21 \div \frac{6}{7} =$
7. $9 \div 1\frac{1}{2} =$	**17.** $8\frac{3}{4} \div 2\frac{1}{3} =$	**27.** $22\frac{1}{3} \div \frac{3}{5} =$
8. $5 \div 6\frac{2}{3} =$	**18.** $8 \div 4\frac{4}{7} =$	**28.** $3 \div 4\frac{4}{12} =$
9. $4 \div \frac{1}{2} =$	**19.** $4\frac{1}{12} \div 2\frac{4}{5} =$	**29.** $\frac{1}{12} \div 3\frac{3}{4} =$
10. $\frac{5}{4} \div 2\frac{1}{2} =$	**20.** $\frac{6}{7} \div \frac{3}{14} =$	**30.** $14 \div \frac{4}{5} =$



AT THE BAKERY

One morning Mr. Frank, our baker, sold the following:

	Number Sold	Doz.	Selling Price a Doz.	Mr. Frank Received
Doughnuts.......	150	?	20¢	?
Raisin Cookies....	180	?	25¢	?
Plain Buns.......	210	?	24¢	?
Sugar Buns.......	92	?	24¢	?
Chocolate Muffins.	56	?	30¢	?

1. How many dozen doughnuts did he sell?

2. What was he paid a dozen?

3. What was he paid for the $12\frac{1}{2}$ dozen doughnuts?

4. How many dozen of each kind of baked goods did he sell?

5. What was the baker paid for all of the cookies that he sold? for the plain buns? the sugar buns? the muffins?

6. How much was the baker paid for all of these goods?

7. Harry bought a half dozen doughnuts. What did he pay for them?

8. Mary bought four sugar buns. What did they cost her?

9. What would 8 chocolate muffins cost?

10. Would half a dozen raisin cookies cost 12¢ or 13¢?

DIVIDING A NUMBER BY A LARGER NUMBER

1. Mary had 6 yards of ribbon and wished to make 8 bows. How long would the ribbon for each bow be?

6 yd. ÷ 8 = ? $6 \div 8 = \frac{6}{8} = \frac{3}{4}$	The line between the numerator and the denominator of a fraction is the sign of division. Therefore $6 \div 8$ can be expressed as $\frac{6}{8}$.

2. If Mary made 9 bows out of the 6 yards of ribbon, how much ribbon would there be in each bow?

3. Mary's mother baked 2 pies. She cut them into 8 equal pieces. What part of a pie was each piece?

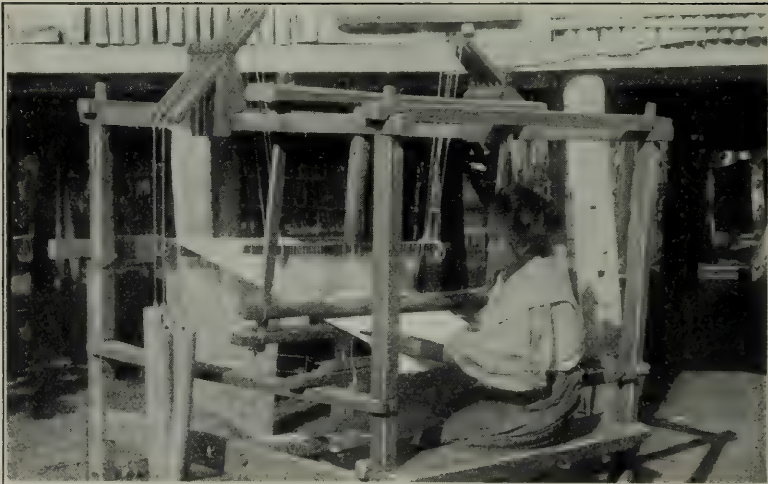
4. Four pounds of candy are to be put into 6 boxes. How much candy will be in each box?

5. Two pounds of flour are enough for two dozen doughnuts. How much flour is needed for one doughnut?

	a	*b*	*c*	*d*
6.	$15 \div 30 =$	$12 \div 15 =$	$9 \div 18 =$	$14 \div 21 =$
7.	$7 \div 9 =$	$6 \div 9 =$	$6 \div 12 =$	$18 \div 27 =$

8. Harry wished to divide 4 apples so that each of 6 children would have an equal share. What fraction of an apple would each of the children receive?

9. What fraction of an hour is 45 minutes?



HOW MACHINERY SHORTENS LABOR

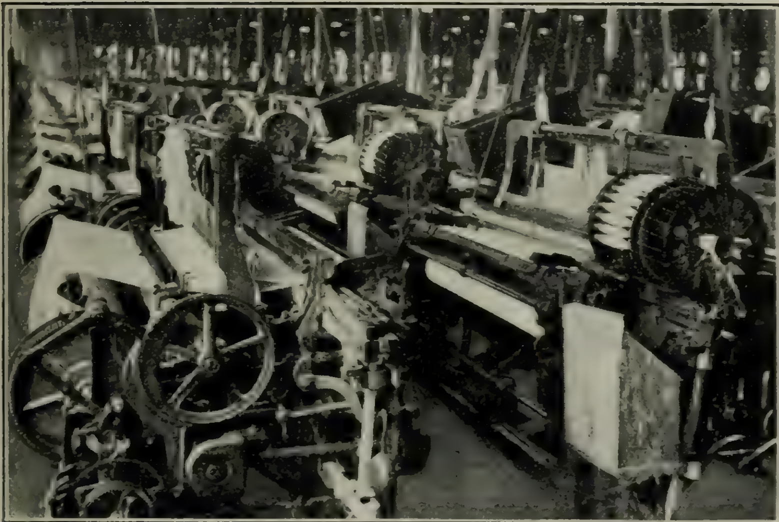
1. A canning company hired 6 men to husk corn. Each man husked $4\frac{1}{2}$ bushels of corn an hour. They worked 10 hours a day. How many bushels did the men husk in a day? in a week of $5\frac{1}{2}$ days?

2. The next season the canning company bought a husking machine which husked a bushel of corn in 2 minutes. They operated the machine 10 hours a day. How many bushels of corn did it husk in a day? in a week of $5\frac{1}{2}$ days?

3. The factories of Fall River, Massachusetts, are said to turn out two miles of cloth every minute of the working day. How many yards of cloth are made every minute?

4. How many yards of cloth are made in Fall River in a working day of 10 hours?

5. Suppose that the average price of the cloth is 35¢ a yard. What is the value of one day's output of cloth?



*6. Suppose all the cloth made in one day is calico or gingham. How many women's dresses would it make if each dress took on the average $4\frac{1}{2}$ yards?

*7. What story do the pictures on pages 166 and 167 tell?

USING FRACTIONS

1. What is the cost of 1 apple, if 2 apples cost 5¢?

2. If a piece of cloth 3 yards long is cut into four equal pieces, how long is each piece?

3. Five boys earned $2 cutting a lawn. They divided the money equally. How much did each boy receive?

Find the cost of 1, if:

4. 2 cost 7¢	7. 5 cost 2¢	10. 20 cost 12¢
5. 3 cost 4¢	8. 8 cost 1¢	11. 12 cost 15¢
6. 4 cost 3¢	9. 20 cost 5¢	12. 15 cost 20¢

DIVIDING A FRACTION BY A WHOLE NUMBER

1. John had $\frac{3}{4}$ pound of candy to divide into three equal parts and to put into 3 bags. How much did he put into each bag?

$\frac{3}{4} \div \frac{3}{1} = \frac{\overset{1}{\cancel{3}}}{4} \times \frac{1}{\underset{1}{\cancel{3}}} = \frac{1}{4}.$ $\frac{3}{4} \div 3 = ?$	Think of 3 as $\frac{3}{1}$. The inverted form of $\frac{3}{1}$ is $\frac{1}{3}$. To divide $\frac{3}{4}$ by 3, multiply $\frac{3}{4}$ by $\frac{1}{3}$.

The inverted form of any number is called its *reciprocal.*

Study the following examples carefully until you understand how they were worked.

2. $\frac{4}{5} \div 2 =$ $\frac{\overset{2}{\cancel{4}}}{5} \times \frac{1}{\cancel{2}} = \frac{2}{5}$

3. $\frac{5}{6} \div 4 =$ $\frac{5}{6} \times \frac{1}{4} = \frac{5}{24}$

4. $\frac{7}{8} \div 5 =$ $\frac{7}{8} \times \frac{1}{5} = \frac{7}{40}$

5. Work examples **2** to **4** with your book closed.

To divide a fraction by a whole number, multiply the fraction by the inverted form of the whole number.

6. Give the inverted form of the following numbers:

8; 7; 6; $\frac{3}{7}$; $\frac{2}{3}$; $1\frac{1}{2}$; 20; $3\frac{2}{3}$; $\frac{4}{9}$; $3\frac{1}{3}$; 5; 12; $2\frac{1}{5}$

Find the answers to the following:

	a	*b*	*c*	*d*
7.	$\frac{1}{3} \div \frac{2}{1} =$	$\frac{1}{2} \div \frac{3}{1} =$	$\frac{1}{4} \div \frac{5}{1} =$	$\frac{2}{3} \div 4 =$
8.	$\frac{2}{3} \div 6 =$	$\frac{3}{5} \div 2 =$	$\frac{3}{4} \div 6 =$	$\frac{6}{10} \div 5 =$
9.	$3\frac{1}{2} \div \frac{2}{3} =$	$8 \div \frac{4}{5} =$	$16 \div 2\frac{2}{3} =$	$\frac{9}{16} \div 9 =$
10.	$\frac{4}{9} \div \frac{2}{15} =$	$7\frac{1}{2} \div 2\frac{1}{2} =$	$\frac{6}{7} \div 8 =$	$6 \div \frac{3}{4} =$
11.	$\frac{5}{6} \div 3 =$	$\frac{15}{16} \div 10 =$	$4\frac{1}{2} \div 2\frac{1}{4} =$	$\frac{8}{15} \div 4 =$

12. Mary cut a $12\frac{1}{2}$-yard piece of cloth into pieces $2\frac{1}{2}$ yards long. How many pieces did she cut?

DIVIDING MIXED NUMBERS BY WHOLE NUMBERS

1. Harry wished to cut a $10\frac{1}{2}$-foot pole into 4 equal pieces. How long would each piece be?

$10\frac{1}{2}$ ft $\div$ **4** = ? $\frac{21}{2} \div \frac{4}{1} = \frac{21}{2} \times \frac{1}{4} = \frac{21}{8} = 2\frac{5}{8}$	Change $10\frac{1}{2}$ to an improper fraction. Multiply $\frac{21}{2}$ by $\frac{1}{4}$.

Study the following examples carefully:

2. $3\frac{1}{3} \div 2 =$ **3.** $1\frac{1}{2} \div 3 =$ **4.** $1\frac{1}{7} \div 9 =$

$\frac{\cancel{10}^{5}}{3} \times \frac{1}{\cancel{2}} = \frac{5}{3} = 1\frac{2}{3}$ $\frac{\cancel{3}}{2} \times \frac{1}{\cancel{3}} = \frac{1}{2}$ $\frac{8}{7} \times \frac{1}{9} = \frac{8}{63}$

Copy these examples and work them with your book closed. Compare your work with the work on this page.

Write the missing numbers and complete the examples.

5. $6\frac{1}{2} \div 4 = \frac{13}{2} \times \frac{1}{\ } =$ **8.** $8\frac{1}{4} \div 2 = \frac{\ }{4} \times \frac{1}{\ }$

6. $7\frac{1}{2} \div 5 = \frac{15}{2} \times \frac{1}{\ } =$ **9.** $7\frac{1}{3} \div 20 = \frac{\ }{3} \times \frac{1}{\ }$

7. $6\frac{2}{3} \div 8 = \frac{20}{3} \times \frac{1}{\ } =$ **10.** $2\frac{1}{5} \div 2 = \frac{\ }{5} \times \frac{\ }{2}$

11. A box containing 12 cans of fruit weighed $15\frac{3}{4}$ pounds. Find the average weight a can.

12. $17\frac{1}{2} \div 2 =$ **16.** $6\frac{1}{2} \div 3 =$ **20.** $7\frac{1}{2} \div 3 =$

13. $21\frac{1}{3} \div 8 =$ **17.** $75\frac{3}{4} \div 6 =$ **21.** $9\frac{1}{3} \div 7 =$

14. $37\frac{1}{2} \div 10 =$ **18.** $45\frac{1}{8} \div 5 =$ **22.** $64\frac{4}{5} \div 4 =$

15. $12\frac{1}{2} \div 5 =$ **19.** $5\frac{1}{2} \div 11 =$ **23.** $84\frac{7}{8} \div 7 =$

24. Harry rode $27\frac{1}{2}$ miles on his bicycle in 6 hours. What was the average number of miles an hour?

25. Mr. Jones sold 6 chickens weighing $32\frac{1}{4}$ pounds. What was the average weight of the chickens?

26. An automobile traveled $76\frac{1}{2}$ miles in 3 hours. What was the average number of miles an hour? At the same rate, how far will it travel in 4 hours?

27. Divide seven and one-fifth by 9.

A USEFUL CHECK IN DIVISION

These examples illustrate three important points in division:

a. $1\frac{1}{2} \div \frac{1}{4} = 6$	***d.*** $8 \div 4 = 2$
b. $1\frac{1}{2} \div 2\frac{1}{4} = \frac{2}{3}$	***e.*** $6 \div 7 = \frac{6}{7}$
c. $1\frac{1}{2} \div 1\frac{1}{2} = 1$	***f.*** $6 \div 6 = 1$

I. If any number is divided by a smaller number, the quotient is always more than 1. Point to the examples above that prove this.

II. If any number is divided by a larger number, the quotient is always less than 1. Point to the examples above that prove this.

III. If any number is divided by a number of equal value, the quotient is always 1. Point to the examples above that prove this.

For which of the following will the answers be 1? more than 1? less than 1? Work the examples.

1. $\frac{1}{2} \div \frac{1}{4} =$	**8.** $9 \div 3 =$	**15.** $12 \div 15 =$
2. $6 \div 5 =$	**9.** $7\frac{1}{2} \div 2\frac{1}{2} =$	**16.** $16\frac{2}{3} \div 8\frac{1}{3} =$
3. $2\frac{1}{2} \div 2 =$	**10.** $4\frac{1}{5} \div 7 =$	**17.** $7\frac{1}{8} \div 5 =$
4. $\frac{2}{4} \div \frac{3}{6} =$	**11.** $6\frac{2}{3} \div 3\frac{1}{3} =$	**18.** $6\frac{3}{4} \div 6\frac{7}{8} =$
5. $\frac{1}{3} \div \frac{2}{3} =$	**12.** $6 \div 8 =$	**19.** $2\frac{1}{2} \div 2\frac{4}{7} =$
6. $8 \div 9 =$	**13.** $1\frac{1}{8} \div 1\frac{1}{8} =$	**20.** $4\frac{2}{3} \div 3\frac{5}{6} =$
7. $\frac{1}{6} \div \frac{1}{8} =$	**14.** $\frac{1}{4} \div \frac{1}{2} =$	**21.** $10 \div 8 =$

TEST ON DIVISION OF FRACTIONS

Do not be satisfied until you can work all of these examples correctly in less than five minutes.

1. $2 \div \frac{1}{4} =$	**5.** $\frac{1}{3} \div \frac{1}{5} =$	**9.** $6\frac{1}{3} \div 2\frac{1}{6} =$
2. $3 \div \frac{4}{5} =$	**6.** $\frac{3}{7} \div \frac{3}{8} =$	**10.** $4\frac{1}{5} \div \frac{7}{19} =$
3. $7 \div 4\frac{1}{6} =$	**7.** $\frac{5}{9} \div 3 =$	**11.** $1\frac{1}{2} \div 6 =$
4. $5 \div 6\frac{2}{3} =$	**8.** $1\frac{1}{2} \div 5\frac{1}{2} =$	**12.** $9\frac{1}{6} \div 5\frac{1}{2} =$

FRED'S FISHING TRIP

Fred and his father are very fond of fishing. Every summer they go on a fishing trip. In his diary Fred tells about the catches of fish and other interesting things about the trips.

1. One summer he and his father went fishing to Wyoming. In the Snake River, Fred caught 4 black spotted trout. One weighed $1\frac{1}{2}$ pounds, another $1\frac{1}{4}$ pounds, another $\frac{7}{8}$ pound, and the smallest $\frac{3}{4}$ pound. What did the four trout weigh?

2. What was their average weight?

3. Another day he caught 5 trout which together weighed $3\frac{3}{4}$ pounds. What was the average weight of each of the 5 trout?

4. The next summer Fred went to northern Minnesota. One day he fished for black bass. He caught one which weighed $2\frac{3}{4}$ pounds, another $1\frac{1}{2}$ pounds, and a large one that weighed $3\frac{1}{4}$ pounds. What was the average weight of the fish?

5. An old fisherman told Fred that he had caught a trout that weighed $4\frac{1}{2}$ pounds. How much more than the largest black bass which Fred caught did the trout weigh?

6. One day Fred fished for brook trout. He caught 6. They weighed 12 ounces; 10 ounces; 8 ounces; 11 ounces; 14 ounces; 1 pound. How many pounds of fish did Fred catch that day?

7. The largest fish Fred ever saw was a muskellunge. It was caught in Lake Chautauqua. The fish was $52\frac{1}{2}$ inches long and weighed 42 pounds.

Fred was 5 feet 1 inch tall and weighed 105 pounds. How many times as heavy as this big fish is Fred?

8. Fred's father told him that "the musky" belongs to the pike family. The pike lives on other fish. A pike will devour daily one-fifth of its own weight of other fish. An average pike weighs about $7\frac{1}{2}$ pounds. What weight of other fish will it devour in one day?

TEST IN DIVISION OF FRACTIONS

Can you work all of these examples correctly?

	a	*b*	*c*	*d*
1.	$5 \div \frac{1}{2} =$	$5 \div \frac{2}{3} =$	$12 \div \frac{3}{4} =$	$14 \div \frac{4}{5} =$
2.	$\frac{1}{7} \div \frac{1}{6} =$	$\frac{1}{9} \div \frac{1}{3} =$	$\frac{3}{8} \div \frac{3}{8} =$	$\frac{13}{15} \div \frac{1}{2} =$
3.	$1\frac{1}{4} \div \frac{1}{3} =$	$1\frac{1}{2} \div \frac{1}{2} =$	$1\frac{3}{8} \div \frac{3}{10} =$	$2\frac{5}{8} \div \frac{3}{4} =$
4.	$\frac{1}{5} \div 5 =$	$\frac{5}{6} \div 4 =$	$\frac{5}{9} \div 5 =$	$\frac{4}{5} \div 6 =$
5.	$1\frac{1}{3} \div 5 =$	$1\frac{1}{5} \div 4 =$	$5\frac{2}{3} \div 5 =$	$5\frac{3}{5} \div 2 =$
6.	$\frac{1}{3} \div 1\frac{1}{2} =$	$\frac{3}{8} \div 1\frac{2}{3} =$	$\frac{5}{12} \div 1\frac{5}{6} =$	$\frac{1}{6} \div 1\frac{1}{2} =$
7.	$2 \div 2\frac{1}{2} =$	$3 \div 4\frac{1}{2} =$	$5 \div 2\frac{3}{4} =$	$5 \div 2\frac{1}{2} =$
8.	$1\frac{1}{5} \div 3\frac{1}{2} =$	$1\frac{1}{3} \div 3\frac{1}{3} =$	$2\frac{3}{8} \div 2\frac{3}{8} =$	$3\frac{1}{3} \div 1\frac{3}{4} =$
9.	$\frac{1}{2} \div \frac{1}{2} =$	$3\frac{1}{2} \div 1\frac{1}{6} =$	$4 \div \frac{4}{5} =$	$7\frac{1}{2} \div 7\frac{1}{2} =$

WHAT THE FARMER RECEIVES FOR RAISING APPLES

1. Mr. Andrews had a $7\frac{1}{2}$-acre orchard. It contained 930 trees. What was the average number of trees an acre?

2. The average yield an acre was 149 bushels. What was the total yield of the orchard?

3. Mr. Andrews received $1.45 a bushel for his apples. What did he receive for the apples raised on an acre? What did he receive for the apples raised in the orchard?

4. He found that the total cost of raising the apples, including labor, marketing, and other expenses, was $90.89 an acre. What was this a bushel?

5. How much more a bushel than it cost to raise the apples did he receive?

6. How much more than his expenses were his receipts an acre?

7. What was his profit on the $7\frac{1}{2}$-acre orchard?

8. Mr. Andrews kept a record of the time he spent working in the orchard and marketing the apples. The average time an acre for different kinds of labor was as follows:

Fertilizing	**$5\frac{2}{3}$ hr.**	**Mowing**	**2 hr.**
Pruning	**$15\frac{5}{8}$ hr.**	**Picking**	**$9\frac{3}{4}$ hr.**
Brush disposal	**3 hr.**	**Sorting and packing**	**$11\frac{1}{2}$ hr.**
Spraying	**$5\frac{1}{2}$ hr.**	**Hauling to market**	**$3\frac{1}{2}$ hr.**

Find the amount of time spent on the $7\frac{1}{2}$-acre orchard.

FIGURING WAGES

Last summer some boys earned money at odd times at the canning factory. They were paid 40¢ an hour. This record shows the number of hours each of the boys worked.

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Total
John	$2\frac{1}{2}$	2	0	$4\frac{3}{4}$	$3\frac{1}{2}$	$\frac{3}{4}$	?
Harry	2	$6\frac{1}{2}$	$3\frac{1}{2}$	$5\frac{1}{4}$	2	0	?
Peter	$6\frac{1}{4}$	0	$2\frac{1}{4}$	$3\frac{1}{2}$	0	$4\frac{3}{4}$	?
George	$2\frac{3}{4}$	3	$3\frac{1}{2}$	$2\frac{1}{2}$	$3\frac{1}{4}$	$3\frac{1}{2}$	?
Arthur	$\frac{1}{4}$	$\frac{1}{2}$	$2\frac{3}{4}$	0	$\frac{3}{4}$	3	?
Total	?	?	?	?	?	?	?

1. Find the total number of hours each day the boys worked.

2. How much longer than John did Harry work on Thursday? on Tuesday?

3. Find the number of hours each boy worked during the week.

4. Find the amount each boy earned by multiplying the total number of hours he worked and the amount paid an hour.

5. Find the average number of hours a day each of the boys worked.

QUESTIONS ABOUT FRACTIONS

Be ready to state the answers to these questions clearly and briefly.

1. What is the numerator of a fraction?

2. What is the denominator of a fraction?

3. What does the denominator show?

4. What does the numerator show?

5. How can a fraction be reduced to lowest terms?

6. How can a fraction be reduced to higher terms?

7. How can a common denominator be found?

8. What is meant by unlike fractions?

9. How can you find what part of a foot 8 inches is?

10. How can an improper fraction be changed to a mixed number?

11. How can the number $12\frac{6}{4}$ be changed to $13\frac{1}{2}$?

12. How can the number $12\frac{1}{2}$ be changed to $11\frac{12}{8}$?

13. Can there ever be a remainder of 0 in subtracting fractions?

14. Is the sum of two proper fractions always less than 1?

15. Can the sum of two proper fractions ever be more than 1?

16. Can the difference between two proper fractions ever be equal to 1?

17. Does it change the value of a fraction to divide both of its terms by the same number?

18. Does it change the value of a fraction to multiply both of its terms by the same number?

19. Tell how to change a mixed number to an improper fraction.

PRACTICE TESTS IN FUNDAMENTALS

Practice the following tests until your scores are up to the standards. The time does not include copying.

Addition Test (8 minutes)

1.	2.	3.	4.	5.	6.
875	867	424	797	989	496
329	924	318	865	876	862
946	748	726	482	564	375
583	563	358	374	643	641
792	877	599	658	372	897
857	592	786	927	291	364
406	475	498	852	875	809
617	386	283	397	968	924

Subtraction Test (3 minutes)

1.	2.	3.	4.	5.	6.
121,985	137,497	75,687	124,732	90,108	136,233
36,689	98,924	52,323	98,765	17,734	47,777

Multiplication Test (10 minutes)

1.	3.	5.	7.	9.	11.	13.
293	932	421	739	239	927	426
908	506	32	86	407	79	86

2.	4.	6.	8.	10.	12.	14.
618	435	729	165	843	917	653
97	79	53	35	53	42	24

Division Test (10 minutes)

1. $64\overline{)698{,}048}$ 3. $73\overline{)468{,}587}$ 5. $28\overline{)37{,}800}$ 7. $76\overline{)173{,}014}$

2. $98\overline{)580{,}552}$ 4. $38\overline{)194{,}940}$ 6. $94\overline{)382{,}966}$ 8. $87\overline{)641{,}103}$

PRACTICE TESTS IN FRACTIONS

Test in Addition

You should be able to find the answers to the examples in this test of addition of fractions in less than 12 minutes. Work carefully and do not hurry. Check your work.

1.	3.	5.	7.	9.	11.
$\frac{1}{8}$	3	$\frac{1}{3}$	$7\frac{1}{4}$	$\frac{1}{4}$	$3\frac{1}{8}$
$\frac{1}{8}$	$2\frac{1}{4}$	$\frac{2}{3}$	$\frac{1}{4}$	$\frac{1}{2}$	$\frac{1}{4}$
				$1\frac{1}{4}$	$4\frac{3}{8}$

2.	4.	6.	8.	10.	12.
$1\frac{1}{8}$	$\frac{1}{4}$	$\frac{1}{3}$	$\frac{3}{8}$	$1\frac{5}{6}$	$4\frac{2}{5}$
$\frac{3}{8}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{5}{6}$	$7\frac{3}{5}$	$\frac{1}{8}$
$\frac{3}{4}$	$1\frac{1}{8}$	$\frac{1}{4}$			$7\frac{5}{8}$

Test in Subtraction

You should be able to find the answers to the examples in this test of subtraction of fractions in less than 12 minutes. Work carefully and check your work.

1.	3.	5.	7.	9.	11.
$\frac{4}{5}$	$4\frac{2}{3}$	$6\frac{1}{4}$	$\frac{7}{8}$	$7\frac{3}{4}$	$5\frac{7}{12}$
$\frac{1}{5}$	$\frac{1}{3}$	6	$\frac{1}{8}$	$\frac{1}{4}$	$1\frac{1}{12}$

2.	4.	6.	8.	10.	12.
$8\frac{4}{5}$	6	$9\frac{1}{5}$	$17\frac{1}{12}$	$48\frac{1}{5}$	$8\frac{1}{5}$
$2\frac{3}{10}$	$5\frac{1}{2}$	$6\frac{2}{5}$	$5\frac{1}{4}$	$26\frac{1}{4}$	$6\frac{3}{8}$

Test in Multiplication

You should be able to find the answers to these examples in less than 12 minutes.

1. $\frac{1}{6} \times 5 =$	5. $\frac{1}{3} \times \frac{1}{3} =$	9. $\frac{3}{4} \times 12 =$
2. $1\frac{1}{4} \times \frac{1}{3} =$	6. $\frac{7}{12} \times \frac{4}{5} =$	10. $\frac{1}{5} \times 1\frac{3}{7} =$
3. $\frac{1}{4} \times 9 =$	7. $1\frac{1}{3} \times \frac{1}{8} =$	11. $3\frac{1}{2} \times 1\frac{1}{9} =$
4. $2\frac{1}{4} \times 2\frac{1}{3} =$	8. $10\frac{1}{4} \times 26 =$	12. $47\frac{5}{9} \times 558 =$

Repeat these tests until you can work all of the examples correctly in less than the time allowed.

REVIEW OF IMPORTANT POINTS

This exercise will review the important points you have learned.

1. What is meant by inverting the divisor?

2. Does $4 \div \frac{2}{3}$ have the same value as $4 \times \frac{3}{2}$?

3. Give the inverted form of the following:

$\frac{4}{5}$ $\frac{11}{2}$ $1\frac{1}{4}$ $2\frac{2}{3}$ 5 6

4. Must fractions be changed to common denominators before they can be divided? Explain.

5. Give the rule for finding the answer to $4 \div \frac{2}{3} =$

6. Give the steps in finding the answer to the following:

$1\frac{1}{2} \div 1\frac{1}{4} =$ $2 \div 2\frac{2}{3} =$ $4\frac{1}{2} \div 2 =$

7. Show how cancellation can be used to find the answer in this example:

$$4\frac{1}{2} \div 2\frac{1}{4} = \frac{9}{2} \times \frac{4}{9} =$$

8. What is the inverted form of $\frac{2}{3}$? $\frac{3}{4}$? $\frac{9}{10}$? $\frac{1}{8}$?

A RUBBER PLANTATION

1. When tapped, the average rubber tree yields 2 ounces of juice a day, of which $\frac{1}{2}$ is rubber. How many ounces of rubber will the average tree yield a day?

2. At this rate, how many trees will it take to yield 1 pound of rubber a day?

3. It requires $4\frac{2}{3}$ ounces of rubber to make a certain article. At the rate of production found in the first problem, in how many days will the average tree yield this much rubber?

4. On a certain plantation one rubber tree produced $11\frac{1}{4}$ pounds of rubber; another, $10\frac{1}{2}$ pounds; and a third, $8\frac{3}{4}$ pounds. What was the average production of these trees?

5. How many more pounds than each of the others did the first tree produce?

6. A certain tree produced, on the average, $\frac{3}{4}$ ounces of rubber a day. How many ounces will it produce in 240 days? how many pounds?

7. On a certain plantation the trees produced, on the average, $10\frac{1}{2}$ pounds in a year. If the price of crude rubber at the plantation was 14¢ a pound, what was the value of the rubber produced by one tree in a year?

8. In 1920 a plantation owner was offered $48\frac{1}{2}$¢ a pound for his crude rubber, but would not sell. That year, because of a slump in the automobile industry, the price fell and the plantation owner had to sell his rubber at $12\frac{3}{4}$¢ a pound. What did he lose a pound by not accepting the first offer?

9. He received in all $2,244 for his rubber. How many pounds did he sell? (See problem **8** for the price that he was paid a pound.)

PROBLEM SCALE V

Standards	
Excellent	9 or 10 correct
Good	7 or 8 correct
Fair	5 or 6 correct
Unsatisfactory	0 to 4 correct

1. In the Calhoun School there were 360 pupils. On a stormy day 325 were present. How many were absent?

2. John works 16 examples in arithmetic a day, on the average. How many does he work in 15 days?

3. Jane has a library containing 45 books. The average cost of the books is 75 cents. Find the cost of the books in Jane's library.

4. Harry had a garden. He worked in his garden $2\frac{1}{2}$ hours on Monday, $3\frac{1}{2}$ hours on Tuesday, and 2 hours on Wednesday. How many hours did he work in all on the three days?

5. A newsboy delivered papers to 48 customers for a month. At the end of the month he collected \$36. What did each customer pay?

6. Mr. Jones bought a \$24 bicycle for Jack at a $\frac{1}{4}$-off sale. What did Mr. Jones pay for the bicycle?

7. Mary cut a piece of ribbon $7\frac{1}{2}$ yards long into three equal pieces. How long was each piece?

8. Mrs. Smith bought 4 pounds of butter. She used $\frac{1}{4}$ pound of the butter for a cake. How much butter did she have left?

9. What fraction of a yard is 18 inches?

10. The school that Harry attends is $\frac{5}{8}$ mile from his home. He comes home at noon for lunch. How far does he walk each day going to and from school?

CHAPTER VI

COMPARING SPEEDS

1. In 1807 Fulton's steamboat, the *Clermont*, made a trip from Albany to New York, 130 miles, in 32 hours. How many miles an hour was this?

2. How many years is it since the *Clermont* made her first trip?

3. The first successful railroad engine, the *Rocket*, could go at the rate of 29 miles an hour. How long did it take the *Rocket* to go 87 miles?

4. A New York Central train traveled from Buffalo to New York at an average speed of $64\frac{1}{3}$ miles an hour. At this rate of speed, how far did the train go in 3 hours?

5. The United States cruiser *Omaha* traveled a distance of 696 miles in 24 hours. At this speed, how far could the *Omaha* travel in 32 hours? Compare your answer with the distance the *Clermont* traveled in 32 hours.

6. An automobile traveled at the rate of 207 miles an hour. How many miles was this a minute?

7. A railroad train traveled 30 miles between two stations in $\frac{3}{4}$ hour. How many miles was this a minute?

8. A special train made the trip from Minneapolis to Omaha, 375 miles, in $9\frac{3}{8}$ hours. What was the rate an hour?

9. An airplane flew 476 miles in $4\frac{1}{4}$ hours. How many miles did it average an hour?

HOW TO KEEP RECORDS

Mary was paid 20 cents an hour for taking care of Mrs. Smith's baby. Here is a record of the time that Mary worked in one week. She gave it to Mrs. Smith on Friday night with all of the blanks filled in. You are to fill in the blanks as Mary did. Make a neat copy of the record and find the missing numbers.

Day	Came	Left	Hr.	Min.	Hr.	Earned
Monday.................	3:30	4:45	1	15	$1\frac{1}{4}$	?
Wednesday..............	3:40	5:10		?	?	?
Thursday...............	3:35	5:00		?	?	?
Friday.................	3:45	4:20		?	?	?

1. How long did Mary work on Monday?

2. Show that 1 hour 15 minutes is $1\frac{1}{4}$ hours.

3. How long did Mary work on Wednesday? how many hours?

4. How long did Mary work on Thursday? how many hours?

5. How long did Mary work on Friday? how many hours?

6. How many hours did Mary work on the four days?

7. At 20 cents an hour, how much did she earn in the four days?

8. How much did she earn on Monday?

9. How much did she earn on Wednesday? Thursday? Friday?

10. Tell how much she earned in four days by finding the sum of the amounts she earned each day. Does your answer check with problem **7**?

MEASURING FARM PRODUCTS BY WEIGHT

In many states grocers and produce men are required to sell by the pound rather than by the bushel or peck. Why? The following table shows standard weights for a few products.

	Pounds a Bushel		Pounds a Bushel
Apples	48	Peas	60
Barley	48	Potatoes	60
Corn (shelled)	56	Rye	56
Clover seed	60	Timothy seed	45
Oats	32	Wheat	60

What is the weight of each of the following items?

1. $\frac{1}{2}$ bu. apples	$3\frac{1}{2}$ bu. oats	2 pk. wheat
2. 1 pk. potatoes	3 bu. barley	$3\frac{1}{2}$ bu. peas
3. $4\frac{1}{2}$ bu. shelled corn	3 pk. clover seed	$2\frac{1}{2}$ bu. rye

What part of a bushel is each of the following items?

4. 12 lb. apples	40 lb. clover seed	15 lb. timothy seed
5. 16 lb. oats	15 lb. potatoes	45 lb. peas

6. Find the cost of a peck of potatoes at $1\frac{1}{2}$¢ a pound.

7. Potatoes were selling at $2.00 a hundred pounds. How much was that a bushel?

8. Mr. Smith bought 260 pounds of clover seed. How many bushels was this?

9. A grocer bought 640 pounds of oats for $6.00. He sold the oats at $.41 a bushel. How much more than he paid a bushel for the oats did he receive?

10. A wagon load of apples weighed 1,760 pounds. What would be the value of the apples at $1.20 a bushel?

11. Find the cost of a peck of potatoes at 10 pounds for 25¢.

OUR WOOL SUPPLY

1. Harry's father, Mr. Wilson, had a flock of 160 sheep. The wool clipped from the sheep weighed 4,640 pounds. What was the average weight of the raw wool from a sheep?

2. When the grease and dirt were removed, the cleaned wool weighed 1,536 pounds. What was the average amount of cleaned wool from a sheep?

3. Sometimes the grease and dirt form $\frac{3}{4}$ of the weight of the raw wool. How much did the grease and dirt in the raw wool clipped from Mr. Wilson's sheep weigh? How much more or less than $\frac{3}{4}$ of the entire weight was this?

4. Mr. Wilson received 42¢ a pound for the cleaned wool. What was the total amount he received for his wool?

5. What was the average value of the wool of a sheep?

6. The average amount of wool used by each person in the United States is about $4\frac{1}{5}$ pounds a year. The cleaned fleece of one of Mr. Wilson's sheep weighs $9\frac{3}{5}$ pounds. How many people would the wool of this sheep supply?

7. How many people can be supplied by all the wool produced that spring by Mr. Wilson's sheep?

***8.** How many pounds of wool will be needed by your family?

***9.** How many pounds will be needed by the people of the state in which you live?

***10.** How many pounds will be needed by the entire population of the United States?

A DIVISION GAME

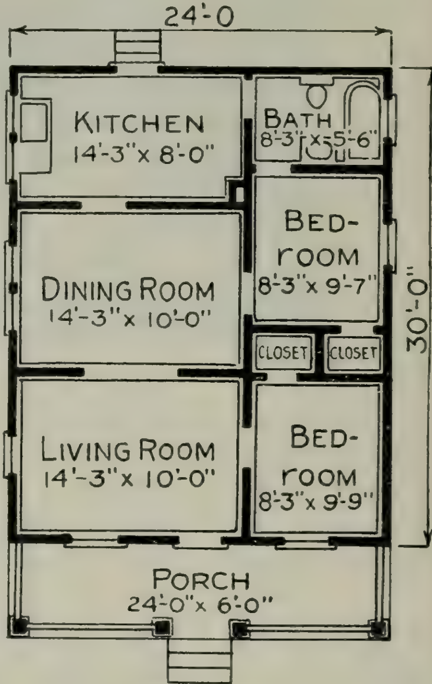
How many of these examples can you work in 20 minutes? Number your paper from 1 to 45 and write the answers.

1. $5 \div \frac{1}{2} =$
2. $7 \div \frac{2}{3} =$
3. $15 \div \frac{3}{4} =$
4. $18 \div \frac{8}{9} =$
5. $\frac{1}{3} \div \frac{1}{2} =$
6. $\frac{1}{6} \div \frac{1}{3} =$
7. $\frac{1}{4} \div \frac{1}{4} =$
8. $\frac{1}{3} \div \frac{1}{4} =$
9. $\frac{1}{6} \div \frac{1}{9} =$
10. $\frac{2}{5} \div \frac{5}{6} =$
11. $\frac{1}{3} \div \frac{5}{6} =$
12. $\frac{5}{6} \div \frac{5}{7} =$
13. $\frac{3}{4} \div \frac{1}{5} =$
14. $\frac{7}{8} \div \frac{3}{4} =$
15. $1\frac{1}{3} \div \frac{1}{4} =$
16. $1\frac{1}{5} \div \frac{1}{5} =$
17. $4\frac{1}{5} \div \frac{3}{4} =$
18. $2\frac{1}{5} \div \frac{7}{8} =$
19. $1\frac{3}{8} \div \frac{3}{10} =$
20. $\frac{1}{2} \div 3 =$
21. $\frac{5}{6} \div 3 =$
22. $\frac{1}{5} \div 6 =$
23. $\frac{2}{3} \div 2 =$
24. $1\frac{1}{3} \div 5 =$
25. $1\frac{1}{5} \div 4 =$
26. $4\frac{1}{2} \div 4 =$
27. $4\frac{1}{2} \div 3 =$
28. $1\frac{3}{8} \div 2 =$
29. $6\frac{2}{3} \div 8 =$
30. $9\frac{2}{5} \div 6 =$
31. $6\frac{3}{4} \div 3 =$
32. $\frac{1}{3} \div 1\frac{1}{2} =$
33. $\frac{1}{2} \div 2\frac{1}{2} =$
34. $\frac{5}{12} \div 1\frac{1}{4} =$
35. $2 \div 2\frac{1}{2} =$
36. $3 \div 4\frac{1}{2} =$
37. $4 \div 1\frac{1}{4} =$
38. $10 \div 1\frac{1}{4} =$
39. $3 \div 1\frac{1}{5} =$
40. $3 \div 7\frac{2}{3} =$
41. $1\frac{1}{5} \div 3\frac{1}{2} =$
42. $2\frac{3}{4} \div 4\frac{2}{5} =$
43. $2\frac{3}{8} \div 2\frac{3}{8} =$
44. $3\frac{1}{3} \div 1\frac{3}{4} =$
45. $3\frac{3}{8} \div 2\frac{1}{4} =$

Practice until you can work the examples in each row in less than 10 minutes.

READING HOUSE PLANS

This is a plan of a bungalow that Jack's father is having built.



1. How long is the bungalow? how wide?

2. What are the dimensions of the living room?

3. Jack's room is to be the front bedroom. What are its dimensions?

4. What two rooms in the house are the same in size?

5. What are the dimensions of the smallest room in the house?

6. How much more than its width is the length of the kitchen?

7. What three rooms are 14 feet 3 inches long?

8. What three rooms are 8 feet 3 inches long?

9. How many windows are shown in the drawing?

10. How many outside doors are there? How many inside doors are there?

11. What is the area of the porch?

12. What will it cost to lay a hardwood floor in the porch at $.30 a square foot?

*13. Find a house plan in some magazine.

DRAWING TO SCALE

1. Measure the length of the plan of the house on page 186.

2. The length of the house, 30 feet, is represented in the plan by how many inches?

3. The width of the house, 24 feet, is represented by how many inches?

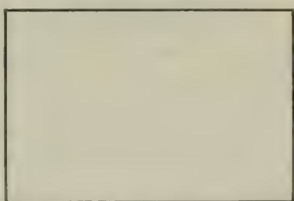
4. How many square inches are there in the plan?

5. How many square feet are there in the area of the floor?

Plans usually are *drawn to scale*. Some short distance, such as $\frac{1}{12}$ inch, stands for some longer distance, such as 1 foot. In the plan of the bungalow, the length of the house, 30 feet, is represented by $2\frac{1}{2}$ inches. How much does each inch represent?

$30 \div 2\frac{1}{2} = 12$	Think: $2\frac{1}{2}$ in. represent 30 ft. The plan is drawn to the scale 1 in. = 12 ft.

6. What distance would a line $1\frac{1}{2}$ inches long represent in a plan drawn to the scale of 1 in. = 12 ft.? $1\frac{1}{2} \times 12 = ?$, the number of feet represented by a $1\frac{1}{2}$-inch line.



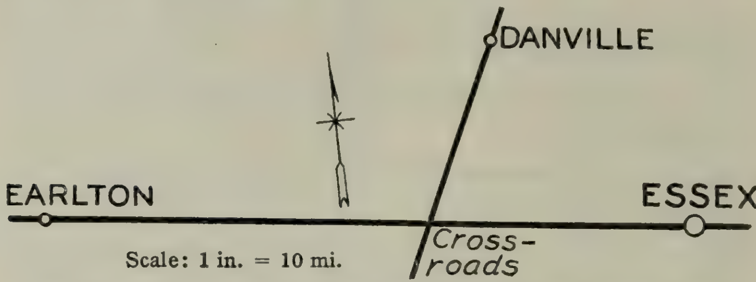
7. Show that the scale used for the width of the house (page 186) is 1 inch = 12 feet.

8. The rectangle at the right represents a park drawn to the scale $\frac{1}{2}$ inch = 20 yards. Using a ruler to measure the rectangle, find the dimensions of the park.

9. Find the perimeter of the park; find the area.

FINDING DISTANCES ON A MAP

This is a small picture of a map of three villages. What is the scale of the map? Tell what *scale* means.



Scale: 1 in. = 10 mi.

1. What distance on the map does $\frac{1}{2}$ inch represent?

2. What distance does $\frac{1}{4}$ inch represent?

3. Measure the length of the line from Earlton to the crossroads. How far is Earlton from the crossroads?

4. Find the distance from Essex to the crossroads.

5. Find the distance from Danville to the crossroads.

6. Find the distance from Earlton to Essex.

7. Find the distance from Danville to Earlton by way of the crossroads.

***8.** Draw this map to the scale of 1 inch = 20 miles.

***9.** Look at a map of the United States in your geography book. Where is the scale placed? What is the scale? What does the scale mean?

***10.** Look at a map of North America. What scale is used? Is the scale the same as for the map of the United States?

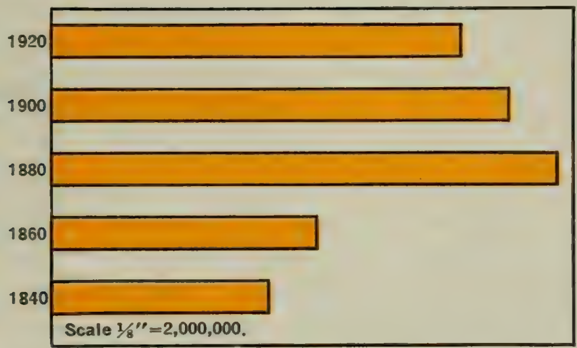
***11.** Look at a map of the world. To what scale is it drawn?

***12.** Why do map scales differ?

***13.** Find the length of a trip by water from Buffalo to Duluth. Use a map of the United States having a scale.

READING A CHART

This chart shows the number of sheep in the United States for the years indicated.



1. In what year did we have the most sheep?

2. Was the number of sheep in 1920 as large as in 1880?

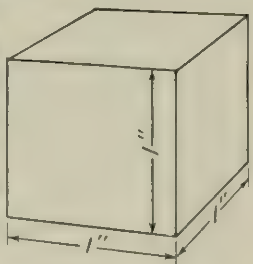
3. Was the number in 1840 as large as the number in 1920?

4. How many eighths of an inch is the length of the bar for 1840?

7. How many millions of sheep were there in the United States in 1840?

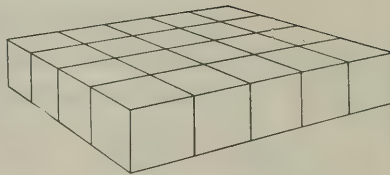
6. Find the number of sheep for each of the years.

MEASURING CONTENTS

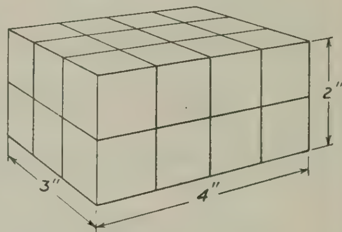


You have learned to measure the contents of pails and boxes by the quart, gallon, and bushel. Another method of measuring contents is called *cubic measure.*

With some soft clay make a small cube 1 inch long, 1 inch wide, and 1 inch thick. Such a cube is equal to a *cubic inch.*



1. Here is a layer of four rows of inch cubes with five cubes in a row. How many cubic inches does the layer contain?



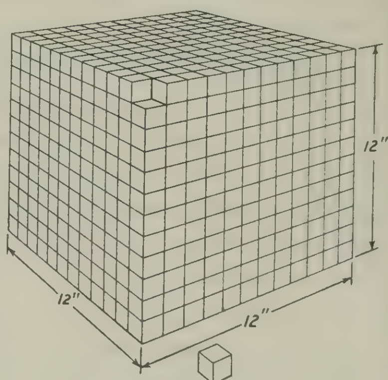
2. How many inch cubes does this box, 4 inches long, 3 inches wide, and 2 inches deep, contain? You can see that there are 2 layers of blocks, each layer consisting of 4 rows of blocks with 3 in a row.

$4 \times 3 \times 2 = ?$, the number of cubic inches.

The number of cubic units in the volume of any rectangular solid is equal to the product of the number of units in the three dimensions.

LARGER UNITS OF CUBIC MEASURE

1. How many cubic inches are there in a cube each dimension of which is 1 foot, or 12 inches? Such a cube is equal to a *cubic foot.*

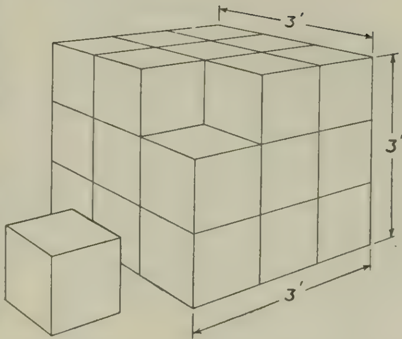


Think: $12 \times 12 \times 12 = ?$

2. Find the cubic contents of a bin 10 feet by 4 feet by 5 feet.

3. How many gallons will a tank contain which has a capacity of 11 cubic feet?

Think: 11 cu. ft. = ? cu. in.
? cu in. ÷ 231 = ? gallons.
(See page 191, Table of Cubic Measure.)



4. How many cubic feet are there in a cube each dimension of which is 3 feet, or 1 yard? Such a cube is equal to a *cubic yard.*

Think: $3 \times 3 \times 3 = ?$ cu. ft.

5. Find the number of cubic yards of dirt that must be hauled away in making an excavation 40 feet by 30 feet by 6 feet.

6. There are about $7\frac{1}{2}$ gallons in a cubic foot. How many gallons of water are needed to fill a swimming pool 60 feet long and 28 feet wide to an average depth of 4 feet?

7. Find the volume of a can 8 inches square and $10\frac{1}{2}$ inches deep.

8. Which has the greater capacity, a bin 10 feet by 6 feet by 5 feet, or a bin 8 feet by 7 feet by 6 feet?

9. Find the weight of the coal in a bin $7\frac{1}{2}$ feet by 6 feet by 4 feet, if coal weighs 80 pounds a cubic foot.

10. A bale of cotton is about $4\frac{1}{2}$ feet long, $2\frac{2}{3}$ feet wide, and $3\frac{3}{4}$ feet thick. How many cubic feet are there in a bale?

11. A wagon load of wood measured 8 feet by 6 feet by 4 feet. Find the cost of the wood at $5.00 a cord.

Table of Cubic Measure
1,728 cubic inches (cu. in.) = 1 cubic foot (cu. ft.) 27 cu. ft. = 1 cubic yard (cu. yd.) 231 cu. in. = 1 gal. 128 cu. ft. of wood = 1 cord of wood

USING CUBIC MEASURE

1. Mr. Smith owned a lot 35 feet by 120 feet, which he wished to use for a garden. He wanted to cover the garden with new, rich soil a foot deep. How many cubic feet of dirt would he need?

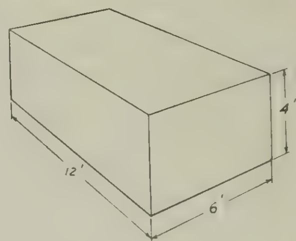
2. He planned to have the Anderson Building Company haul the dirt to the lot by the truck load. If a truck can bring 100 cubic feet of dirt in a load, how many loads should Mr. Smith order?

3. Mr. Andrews had built a new garage. The roadway was 48 feet long and 10 feet wide. He wished to cover it with 6 inches of cinders. How many wagon loads of cinders should he order, if a wagon load is equal to a cubic yard?

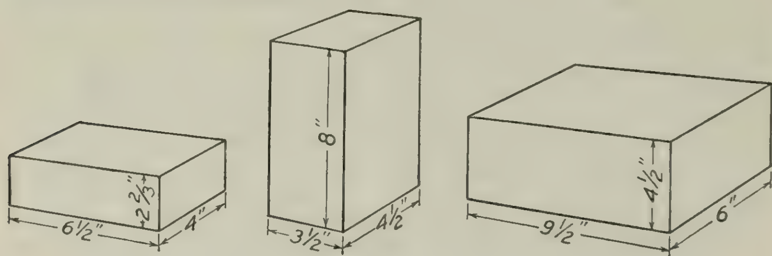
4. How many cubic yards must be dug to prepare for a basement 30 feet long, 25 feet wide, and 4 feet deep?

5. How many cubic inches are there in a box $7\frac{1}{2}$ inches long, $8\frac{1}{2}$ inches wide, and 1 foot deep?

6. Find the volume of a box with the dimensions given in the figure at the right.



7. What is the volume of each of the following rectangular solids?



PROBLEMS OF MEASUREMENT

1. The school nurse weighed Mary in September. Her weight then was $68\frac{1}{2}$ pounds. Her weight in the following June was $72\frac{5}{8}$ pounds. How much had she gained?

2. John weighs $58\frac{1}{4}$ pounds, which is $3\frac{3}{8}$ pounds below his normal weight. What is his normal weight?

3. A plumber worked $7\frac{1}{2}$ hours on Monday, $5\frac{1}{4}$ hours on Tuesday, and $6\frac{3}{4}$ hours on Wednesday. What did he receive for the three days' work if his wages were $1.30 an hour?

4. The length of a lot is 137 feet and the width is 52 feet. Find the length of a fence around the lot.

5. The pupils in a room brought 500 pounds of old paper for a paper sale. At $.60 a hundred pounds, what did they receive for the paper?

6. How many quarts of ice cream will be needed for a class of 40 children, allowing 8 dishes to a quart?

7. The temperature at noon for each day of the week was as follows: Monday, 40°; Tuesday, 34°; Wednesday, 29°; Thursday, 30°; Friday, 33°; Saturday, 38°; and Sunday, 41°. What was the average for the week?

8. How many 6-inch badges can be made from a ribbon 8 yards long?

9. A load of coal weighed 4,000 pounds. Find the cost at $18.75 a ton.

10. What would a milkman receive for 3 gallons of cream which he poured into $\frac{1}{2}$-pint bottles and sold at 20¢ a bottle?

11. A man was 72 inches tall. How many yards was this?

12. In a plan drawn to the scale of $\frac{1}{4}$ inch for 4 feet, how long a line would represent 2 feet? 8 feet? 40 feet?

USING FRACTIONS IN DENOMINATE NUMBERS

Be ready to supply the missing numbers.

1. 3 pk. = —— bu. = —— qt.
2. $\frac{1}{2}$ yd. = —— in. = —— ft.
3. 66 in. = —— ft. = —— yd.
4. 15 min. = —— hr.
5. 4 mo. = —— yr.
6. 6 qt. = —— gal.
7. 2,500 lb. = —— t.
8. 8 oz. = —— lb.
9. $\frac{1}{2}$ mi. = —— yd. = —— rd. = —— ft.
10. $\frac{1}{2}$ a. = —— sq. rd.
11. $1\frac{2}{3}$ yr. = —— mo.
12. $2\frac{1}{2}$ gal. = —— qt.
13. $2\frac{1}{2}$ t. = —— lb.
14. 2 hr. 30 min. = —— hr. = —— min.
15. 3 bu. 2 pk. = —— bu. = —— pk.
16. 4 ft. 8 in. = —— ft. = —— in.
17. 2 qt. 1 pt. = —— qt. = —— pt.
18. 6 lb. 10 oz. = —— lb. = —— oz.
19. $1\frac{1}{2}$ sq. ft. = —— sq. ft. —— sq. in.
20. $\frac{2}{3}$ sq. yd. = —— sq. ft. = —— sq. in.
21. $\frac{1}{2}$ rd. = —— yd. = —— ft.
22. 4 mi. 180 rd. = —— mi. = —— rd.
23. $2\frac{3}{4}$ yd. = 2 yd. —— in. = 2 yd. —— ft.
24. 10 ft. 4 in. = —— ft. = —— in.
25. 8 = —— doz.; 15 = —— doz.
26. 18 oz. = —— lb. —— oz.
27. 75 in. = —— ft. —— in.
28. 2,500 lb. = —— t. —— lb.
29. 14 qt. = —— gal. —— qt.

APPLICATION OF FRACTIONS

1. A girl bought $1\frac{1}{2}$ pounds of coffee at \$.60 a pound. What was the cost of the coffee?

2. Silk costs \$4.50 a yard. If $3\frac{3}{4}$ yards are needed for a dress, how much does the silk for such a dress cost?

3. A man farming on shares receives $\frac{2}{3}$ of the crops. What is his share of a wheat crop of 1,149 bushels?

4. Harry fed his chickens $1\frac{1}{2}$ pounds of grain a day. How many pounds would he need for a month of 30 days?

5. How much would a plumber, working $18\frac{3}{4}$ hours, receive for his work at the rate of \$1.40 an hour?

6. Mary bought $1\frac{1}{2}$ yards of red ribbon and $1\frac{3}{4}$ yards of blue ribbon. How much ribbon did she buy? What did the ribbon cost at 40 cents a yard?

7. A year ago last September Alice weighed $63\frac{1}{2}$ pounds. Last September she weighed $66\frac{3}{4}$ pounds. What was her gain in weight that year?

8. Jack said to Harry, "I live only half as far away from school as you do." If Jack lives $1\frac{1}{2}$ miles away from school, how far away does Harry live?

9. A small basket of tomatoes weighed $10\frac{1}{2}$ pounds. The empty basket weighed $\frac{7}{8}$ pound. What was the weight of the tomatoes?

10. Mary has a ribbon $10\frac{1}{2}$ feet long. How many small 18-inch ribbons can she cut from this piece?

11. Find the cost of $3\frac{3}{4}$ pounds of round steak at 36¢ a pound.

12. Mrs. Smith bought $4\frac{1}{2}$ pounds of candy. She divided this candy into three equal amounts and placed it into three boxes. How much did she put in each box?

13. A class in nature study took four hikes during one month. The first week they walked $2\frac{1}{4}$ miles, the next week $1\frac{1}{2}$ miles, the next week $2\frac{3}{8}$ miles, and the last week $2\frac{3}{4}$ miles. How many miles in all did they walk on their four hikes?

14. Louis and Harry built a small shed for their chickens. They used 240 feet of lumber at $\$.18\frac{1}{2}$ a foot, $2\frac{3}{4}$ pounds of nails at \$.08 a pound, and 3 cans of paint which cost \$.20 each. Find the total cost of the chicken shed.

15. Find the volume of a box $6\frac{1}{2}$ inches long, $7\frac{1}{2}$ inches wide, and 8 inches deep.

16. Allowing 35 cubic feet to the ton, how many tons of coal will a bin 12 feet long, 15 feet wide, and 11 feet deep hold?

17. During Christmas week Ralph, Gerald, and John worked for three days. They kept a record of the amount of time they worked as follows:

	Time in Hours			
	Monday	Tuesday	Wednesday	Total
Ralph	$7\frac{3}{4}$	$7\frac{1}{2}$	$8\frac{3}{4}$	?
Gerald	$8\frac{1}{2}$	$8\frac{3}{4}$	$8\frac{1}{4}$	?
John	$7\frac{3}{4}$	8	$8\frac{1}{2}$	?
Total	?	?	?	

Find the total amount of time the three boys worked on Monday; on Tuesday; on Wednesday.

18. Find the total amount of time each of the three boys worked.

19. Mary worked 25 arithmetic examples in $6\frac{1}{4}$ minutes. How many examples a minute did she work on the average?

A COMPLETION TEST

In each of the following sentences there are blanks. Each blank stands for a missing word or number. Number twenty lines on your paper. On the first line write the word missing in the first sentence. Continue with the other sentences until you have completed the exercise.

1. In order to find the cost of 5 bushels of apples it is necessary to know the —— a bushel.

2. $7\frac{1}{2}$ and $6\frac{2}{3}$ are —— numbers.

3. A square foot is a unit of —— measure.

4. To find the perimeter of a square one must know the length of one ——.

5. The area of a rectangle equals its —— times its ——.

6. $\frac{3}{4}$ is the inverted form of ——.

7. Multiplying the terms of a fraction by the same number does not —— its value.

8. An acre equals —— square rods.

9. An acre is —— of a square mile.

10. Thirty minutes is —— of an hour.

11. $\frac{1}{3} \times \frac{3}{8}$ equals ——.

12. Materials sold at a discount are sold for —— than the regular price.

13. Plans of buildings are drawn to ——.

14. Coal is usually measured by the ——.

15. Seven inches is equal to —— foot.

16. $\frac{3}{4} - \frac{3}{8} =$ ——.

17. In the fraction $\frac{8}{9}$, 9 is called the ——.

18. $\frac{4}{5}$ is —— to lowest terms.

19. The inverted form of 5 is ——.

20. \$1.50 is —— times as much as \$.50.

REVIEW OF IMPORTANT POINTS

This exercise will review the important points you have learned.

1. What must be done before $1\frac{1}{4}$ and $3\frac{2}{3}$ can be added?

2. The sum of two mixed numbers was given as $8\frac{9}{6}$ by a pupil. Why was this answer not accepted as correct?

3. Before you can subtract $4\frac{3}{4}$ from $6\frac{1}{2}$ how must $6\frac{1}{2}$ be changed in form? Find the answer to the example.

4. Must fractions that are to be multiplied be changed to a common denominator?

5. Reduce $4\frac{1}{3}$ to an improper fraction.

6. Show how cancellation may be used in working this example.

$$7\frac{1}{2} \times 4\frac{2}{3}$$

7. What is the inverted form of each of these numbers: $\frac{1}{3}$? $\frac{2}{5}$? 6? $4\frac{1}{2}$? $5\frac{1}{3}$?

8. What is meant by "dimensions"?

9. What must you know before you can find the area of a field?

10. What must you know before you can find the volume of a box?

11. How can you find the perimeter of a field?

12. Show that a square is a rectangle.

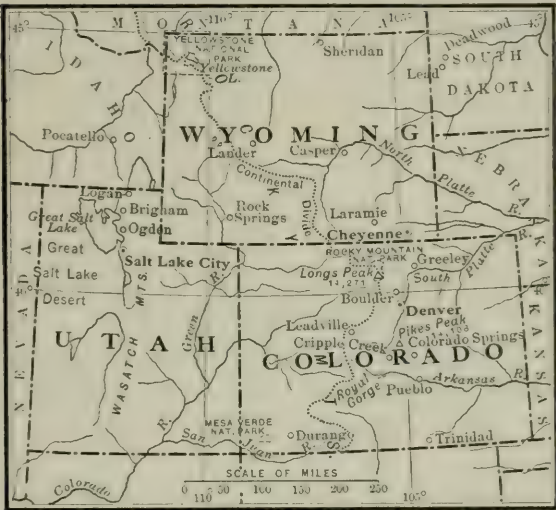
13. Why are plans of houses drawn to scale?

14. Name four units for measuring weight. Name something that is measured by each.

15. Name four units for measuring each of the following, and name something that will be measured by each: area; time; volume; length; value.

16. Many pupils fail to work examples like this one. $3\frac{1}{3} \div 10 =$. Why do you think they might make mistakes?

MAP STUDY



1. Measure carefully the boundaries of Colorado, and find the perimeter of this map of Colorado in inches.

2. Colorado on the map is nearly the shape of a rectangle. Find the area of this rectangle in square inches.

3. How many square miles does a square inch of surface on the map represent? (See scale.)

4. Refer to your answers for problems **2** and **3**, and calculate the area of Colorado in square miles.

5. Look up the true area of Colorado and find how many square miles your answer is greater or less than the true area. Account for the difference.

6. Measure the length and width of the map of Wyoming in inches, and, using the scale, find the length and width of Wyoming.

OUR BASKET-BALL TEAM

What is the average weight and height of the following members of the Clay School basket-ball team?

	Weight in Pounds	Height in Inches
John	$97\frac{1}{4}$	$62\frac{1}{4}$
Harry	$95\frac{1}{2}$	$60\frac{7}{8}$
Carl	$106\frac{3}{4}$	$63\frac{1}{2}$
Richard	$104\frac{1}{2}$	$59\frac{3}{4}$
Keith	$101\frac{1}{4}$	$61\frac{3}{8}$

A MULTIPLICATION GAME

Write the answers to the following examples on your paper. How many can you work in 20 minutes?

1. $\frac{1}{4} \times 8 =$
2. $\frac{1}{9} \times 3 =$
3. $\frac{1}{8} \times 3 =$
4. $\frac{1}{2} \times 7 =$
5. $\frac{1}{4} \times 1 =$
6. $\frac{2}{3} \times 12 =$
7. $\frac{2}{9} \times 3 =$
8. $\frac{2}{5} \times 2 =$
9. $\frac{2}{3} \times 16 =$
10. $\frac{5}{6} \times 14 =$
11. $5 \times \frac{1}{8} =$
12. $3 \times \frac{1}{6} =$
13. $4 \times \frac{1}{2} =$
14. $12 \times \frac{1}{5} =$
15. $8 \times \frac{1}{6} =$
16. $7 \times \frac{1}{3} =$
17. $\frac{3}{4}$ of $16 =$
18. $\frac{7}{8}$ of $24 =$
19. $2 \times \frac{4}{9} =$
20. $3 \times \frac{4}{10} =$
21. $4 \times \frac{3}{4} =$
22. $4 \times \frac{2}{5} =$
23. $12 \times \frac{3}{8} =$
24. $\frac{1}{4} \times \frac{1}{6} =$
25. $\frac{1}{4} \times \frac{8}{9} =$
26. $\frac{1}{2} \times \frac{7}{10} =$
27. $\frac{1}{3} \times \frac{3}{4} =$
28. $\frac{4}{5} \times \frac{1}{2} =$
29. $\frac{2}{3} \times \frac{4}{5} =$
30. $\frac{4}{5} \times \frac{7}{8} =$
31. $\frac{5}{6} \times \frac{3}{10} =$
32. $\frac{5}{9} \times \frac{3}{7} =$
33. $\frac{4}{5} \times \frac{10}{12} =$
34. $\frac{3}{5} \times \frac{5}{9} =$
35. $\frac{1}{2} \times \frac{2}{5} =$
36. $\frac{3}{4} \times \frac{8}{9} =$
37. $6 \times 2\frac{1}{3} =$
38. $7 \times 4\frac{1}{2} =$
39. $6 \times 3\frac{1}{4} =$
40. $2\frac{1}{2} \times 4 =$
41. $3\frac{1}{5} \times 2 =$
42. $3\frac{1}{6} \times 4 =$
43. $\frac{1}{4} \times 2\frac{1}{2} =$
44. $\frac{1}{2} \times 1\frac{1}{5} =$
45. $\frac{5}{8} \times 6\frac{4}{5} =$
46. $\frac{1}{12} \times \frac{2}{3} =$
47. $2\frac{1}{2} \times 2\frac{1}{4} =$
48. $6\frac{1}{4} \times 6\frac{2}{5} =$
49. $9\frac{2}{3} \times 2\frac{1}{3} =$
50. $3\frac{3}{4} \times 3\frac{1}{3} =$
51. $1\frac{1}{3} \times 2\frac{2}{5} =$
52. $3\frac{2}{3} \times 4\frac{1}{6} =$
53. $8 \times 2\frac{1}{2} =$
54. $7\frac{1}{2} \times 4 =$

TESTS IN THE FUNDAMENTALS

Addition (10 minutes, including checking but not copying)

1. 875	**2.** 867	**3.** 424	**4.** 797	**5.** 989	**6.** 496
329	924	318	865	876	862
946	748	726	482	564	375
583	563	358	374	643	641
792	877	599	658	372	897
857	592	786	927	291	364
406	475	498	852	875	809
617	386	283	397	968	924

Subtraction (3 minutes, including checking but not copying.)

1. 121,985	**2.** 137,497	**3.** 75,687	**4.** 124,732	**5.** 90,108	**6.** 136,233
36,689	98,924	52,323	98,764	17,734	47,777

Multiplication (6 in 3 minutes, including checking but not copying)

1. 293	**3.** 932	**5.** 421	**7.** 739	**9.** 239	**11.** 927	**13.** 426
908	506	32	86	407	79	86
2. 618	**4.** 435	**6.** 729	**8.** 175	**10.** 843	**12.** 917	**14.** 653
97	79	53	35	53	42	24

Division (6 in 8 minutes, including checking but not copying)

1. 64)698,048	**4.** 73)468,587	**7.** 28)37,800	**10.** 76)173,014
2. 98)580,552	**5.** 38)194,940	**8.** 94)382,966	**11.** 87)641,102
3. 375)90,000	**6.** 296)120,472	**9.** 906)830,802	**12.** 487)258,597

Do special work on the processes in which your test scores were the lowest.

PROBLEM SCALE VI

Standards	
Excellent......	9 or 10 correct
Good..........	7 or 8 correct
Fair...........	5 or 6 correct
Unsatisfactory .	0 to 4 correct

1. Frank sells 10 papers a day and makes 2 cents on each paper. How long will it take him to earn enough to buy a pair of skates that cost \$2.00?

2. Harry delivered 17 papers on Monday, 25 on Tuesday, and 25 on Wednesday. How many papers did he deliver in the three days?

3. Ruth wished to buy a banner that cost \$1.50. She had 75 cents but had to buy a tablet and pencil for 15 cents. How much more did she need before she could buy the banner?

4. Helen bought a roast for \$2.47 and a steak for \$1.43. What change should she receive from a ten-dollar bill?

5. One morning Harry dug $4\frac{1}{2}$ bushels of potatoes in his garden. He sold 3 bushels to a neighbor. That afternoon he dug $3\frac{1}{2}$ bushels of potatoes. How many bushels of potatoes did Harry then have?

6. Mrs. Smith bought $4\frac{1}{2}$ yards of ribbon at 30 cents a yard and some cloth for 60 cents. What must she pay?

7. Alice wished to make 4 May baskets. She needed $\frac{1}{2}$ yard of ribbon for each one. What would the ribbon cost at 15 cents a yard?

8. On Monday, Mary practiced her music lesson 45 minutes; on Tuesday, 1 hour; and on Wednesday, 30 minutes. How many hours did she practice on these three days?

9. Find the area of a room $10\frac{1}{2}$ feet long and 12 feet wide.

10. Find the perimeter of a room $10\frac{1}{2}$ feet by 12 feet.

CHAPTER VII

THE DECIMAL SYSTEM

Our method of numbering is called the decimal system because it is built with tens. The Latin word for ten is *decem*, hence the word *decimal*.

1. How many 1's are there in 10?

2. How many 10's are there in 100? in 1,000?

3. How many 100's are there in 1,000?

4. How many cents are there in a dime?

5. How many dimes are there in a dollar?

6. In writing dollars and cents you have used the decimal system, for you used the decimal point to separate dollars and cents. On which side of the decimal point are cents written? On which side are dollars written?

7. What part of a dollar is a dime?

8. How many tenths of a dollar are 3 dimes? 7 dimes?

9. What part of a dollar is 1 cent? 7 cents? 27 cents?

10. In $34.96, what amount of money does the 6 stand for? the 9? the 4? the 3?

11. How many dimes or tenths of a dollar are expressed in each of the following amounts? how many pennies or hundredths of a dollar?

$4.76 $.28 $.50 $7.04 $9.00 $6.08 $.01

Think: In $4.76 there are 7 dimes, or 7 tenths of a dollar; 6 pennies, or 6 hundredths of a dollar.

12. How many hundredths of a dollar is $.10?

DECIMAL FRACTIONS

You see that \$4.86 is the same as $\$4\frac{86}{100}$. .86 means the same as $\frac{86}{100}$. $\$\frac{86}{100}$ is \$.86, written as a common fraction. The decimal point in \$.86 shows that the denominator $\overline{100}$ is not needed. Common fractions, like $\frac{1}{10}$, $\frac{17}{100}$, $\frac{195}{1000}$, may be written in the decimal form as decimal fractions.

Common Fractions	Name	Decimal Fractions
$\frac{1}{10}$	One-tenth	.1
$\frac{17}{100}$	Seventeen-hundredths	.17
$\frac{195}{1000}$	One hundred ninety-five thousandths	.195

If one figure is written after the decimal point, it is read *tenths*. If two figures are written after the decimal point, they are read as *hundredths*. If three figures are written after the decimal point, they are read as *thousandths*.

Read these decimal fractions:

1. .8 .4 .9 .1 .7 .6 .15 .37 .68 .43

2. .268 .5 .347 .42 .425 .2 .30 .99 .765 .534

Write these common fractions as decimal fractions:

3. $\frac{1}{10}$ $\frac{3}{10}$ $\frac{9}{10}$ $\frac{4}{10}$ five-tenths

4. $\frac{25}{100}$ $\frac{16}{100}$ $\frac{75}{100}$ $\frac{14}{100}$ $\frac{99}{100}$ $\frac{375}{1000}$

Mixed numbers, like $2\frac{1}{10}$, $16\frac{25}{100}$, and $9\frac{16}{1000}$, may also be written as mixed decimals.

Mixed Numbers	Name	Mixed Decimals
$2\frac{1}{10}$	Two and one-tenth	2.1
$16\frac{25}{100}$	Sixteen and twenty-five hundredths	16.25
$9\frac{16}{1000}$	Nine and sixteen thousandths	9.016

Notice that the whole numbers are written first; then the decimal point is placed to indicate that a decimal fraction is being written as a part of the number. In reading mixed decimals, always say *and* to show where the decimal point is placed.

Write these mixed numbers as mixed decimals:

5. $9\frac{1}{10}$ $6\frac{7}{10}$ $25\frac{9}{10}$ $40\frac{4}{10}$ $7\frac{3}{10}$

6. $2\frac{15}{100}$ $8\frac{17}{100}$ $19\frac{25}{100}$ $40\frac{75}{100}$ $15\frac{256}{1000}$

7. \$.25 means 25¢ or $\frac{25}{100}$ of a dollar. Express 35¢ as a fraction of a dollar. Express 35¢ in the decimal form.

8. $\frac{1}{2}$ of a dollar equals——cents. Therefore, $\frac{1}{2}$ of a dollar equals $\frac{50}{100}$ of a dollar.

9. \$.05 means —— cents or $\frac{?}{100}$ of a dollar.

10. .05 foot means ? or five hundredths of a foot.

11. 4.08 miles = ? miles or 4 and 8 hundredths miles.

12. Read these numbers. Be ready to write them from dictation.

.6	2.4	3.19	17.8	16.04	.075	.26
2.8	14.03	.03	20.04	.6	2.8	19.954

Write the following in decimal form:

13. Four tenths.

14. Sixteen hundredths.

15. Nine and seven tenths.

16. Eight hundredths.

17. Seven hundredths.

18. Five and nine hundredths.

19. One hundred forty-six thousandths.

20. Sixty-four thousandths.

21. One hundred five and one tenth.

22. Nineteen and forty-six hundredths.

23. Fifteen and seventy-one thousandths.

24. One hundred one and one hundredth.

READING AND WRITING DECIMALS

In the following sentences decimals are used instead of common fractions. Write the decimals from dictation.

1. A cubic foot of water weighs 62.5 pounds. Stated more accurately, its weight is 62.48 pounds.

2. A cubic foot of water contains 7.5 gallons.

3. A bushel equals 2,150.42 cubic inches.

4. Gasoline weighs about .75 as much as water.

5. A degree of longitude at the equator equals 69.16 miles.

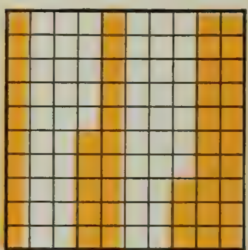
6. A knot, which is used to express distance in travel by water, equals about 1.151 miles.

7. A cubic foot of cork weighs .24 as much as a cubic foot of water.

PICTURING DECIMALS


A

1. How many tenths of bar *A* are shaded?


B

2. How many tenths are not shaded?

3. In figure *B* what part of the large square does each small square represent?

4. How many hundredths are there in the shaded part at the left? $\frac{10}{100}$ = what fractional part of the square?

5. How many tenths and hundredths are shaded in the center? 1 tenth + 5 hundredths = ? hundredths.

6. How many hundredths are shaded to the right?

7. How many hundredths in all are shaded?

ADDITION OF DECIMALS

1. Harry was in charge of the milk fund. On Monday he paid the milkman $2.48, on Wednesday $2.40, and on Thursday $2.00. What did he pay in all?

$2.48 2.40 2.00 6.88	Copy the numbers so that the decimal points are in a straight line up and down; then add. Place the decimal point in the sum directly under the decimal points in the numbers added.

2. A boy rode 12.5 miles on his bicycle on Monday, .6 of a mile on Tuesday, and 15.0 miles on Wednesday. How far did he ride in the three days?

12.5 .6 15.0 28.1	Copy the numbers so that the decimal points are in a straight line. Place the decimal point in the answer directly under the decimal points in the numbers added.

3. An aviator made one flight of 14.45 miles, another of 15.60 miles, and another of 24.07 miles. How many miles was that in all?

14.45 15.60 24.07 54.12	Be sure that the decimal points are always in a straight line.

Find the following sums:

4. .8 + 4.7 + 8.0 =

5. 3.54 + 6.42 + 5.95 =

6. 1.725 + 2.746 + 5.974 =

7. 1.56 + .78 + .75 =

ADDING MORE DIFFICULT DECIMALS

$$\begin{array}{r} 7.5 \\ 8.65 \\ 9. \\ \hline 25.15 \end{array}$$

Sometimes you must add decimals like these: $7.5 + 8.65 + 9. = ?$

Write these numbers so that the decimal points will be in a straight line. Add the hundredths; then the tenths, and so on. Study the example.

Find the sums of the following. Be sure to place the decimal points in a straight line under each other.

1. $9.0 + 6.75 + 8.4 =$

2. $8.45 + .6 + 9.4 =$

3. $8.7 + 1.65 + 5.826 =$

4. $.7 + .9 + .16 =$

5. $.5 + 1.625 + 5.75 =$

6. $.75 + 56.84 + .025 =$

7. $8.6 + 9.5 + .75 =$

8. $.04 + .9 + 1.867 =$

9. Find the distance around a garden 18.5 feet long and 16.25 feet wide.

10. Find the weight of three chickens, one weighing 3.5 pounds, one weighing 3.75 pounds, and one weighing 4.125 pounds.

COMPARING FRACTIONS AND DECIMALS

1. Which is more, $\frac{1}{2}$ or .5?

To find out, change $\frac{1}{2}$ to tenths.

$\frac{1}{2} = \frac{5}{10} = .5$

Therefore, $\frac{1}{2}$ and .5 have the same value.

Express these fractions as tenths and then write them as decimals:

2. $\frac{1}{5}$ **3.** $\frac{2}{5}$ **4.** $\frac{4}{5}$ **5.** $\frac{3}{5}$

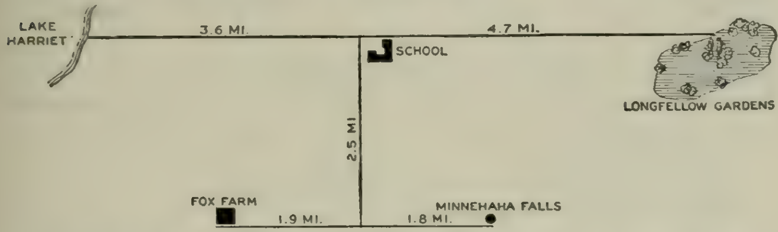
Express as hundredths and then write as decimals:

6. $\frac{1}{4}$ **7.** $\frac{3}{4}$ **8.** $\frac{17}{20}$ **9.** $\frac{7}{25}$ **10.** $\frac{1}{2}$

11. Which is more, $\frac{1}{4}$ or .35? $\frac{1}{2}$ or .45?

PLANNING A HIKE

A group of Camp-fire Girls was planning to take a hike in the country on Saturday. This map was prepared by a committee to show the places they might visit and the distances from the school to each place.



1. How far is it from the school to Minnehaha Falls?

2. How far is it from the school to the fox farm?

3. Is it as far from the school to Longfellow Gardens as from the school to the fox farm?

4. How far is it from Lake Harriet to Minnehaha Falls?

5. Which place is the greatest distance from the school?

6. The club decided to meet at Longfellow Gardens and then hike to the fox farm. What is the distance?

7. One of the girls lives near Lake Harriet. She rode from home to Longfellow Gardens in her father's automobile. How far did she ride?

8. The girls decided to buy the following amounts of food for each of the 24 members of the group from money in the club treasury:

Bacon $\frac{1}{8}$ lb.	**@ 50¢ lb.**
Bread $\frac{1}{4}$ lb. loaf	**@ 9¢ loaf.**
Oranges (2 for each girl)	**@ 47¢ doz.**

Find the total cost of this food for the group.

ANNEXING ZEROS TO DECIMALS

1. Two dollars may be written in two ways, \$2 or \$2.00. Write four dollars in two ways.

2. If you had \$2 and spent 48¢, what would you have left?

\$2.00 **.48** **\$1.52**	In order to subtract, write \$2 as \$2.00. Is the value of \$2 changed by placing a decimal point after \$2 and annexing two zeros?

3. Is 4.0 ft. the same as 4 ft.? Explain.

4. Is 5 mi. the same as 5.00 mi.?

5. Is 5.1 mi. the same as 5.10 mi.?

Think: $.1 = \frac{1}{10}$; $.10 = \frac{10}{100} = \frac{1}{10}$. Therefore $5.1 = 5.10$.

This shows that *zeros may be annexed to a number to the right of a decimal point without changing the value of the number.*

Which of the following are correct? Why? Which are incorrect? Why?

	a	*b*	*c*	*d*
6.	.7 = .70	1. = .10	2.5 = 2.50	5 = 5.0
7.	.80 = .8	.2 = .02	3.50 = 3.5	50 = 5
8.	1.9 = 1.90	4.30 = 4.3	46 = 46.00	200 = 20

9. Express the following as hundredths:

.4 .7 .8 .2 .1 .5 .3 .6 .9

10. Express the following as tenths:

.20 .50 .60 .80 .90 .40 .30 .70

11. Is .25 more than .20? How can you tell?

12. Which of the following have the same value as five-tenths?

$\frac{1}{2}$ .50 .05 .5 .500 .5000

SUBTRACTING DECIMALS

Subtracting decimals is much like subtracting dollars and cents. Subtract the following:

	a	*b*	*c*	*d*	*e*	*f*
1.	$4.96	$5.16	$7.00	$9.15	$8.04	$6.20
	1.85	2.08	.65	9.10	.50	.04

How are the decimal points in the examples placed? Where are the decimal points in the answers placed?

2. Find the amount of change if a $5 bill is given in payment for groceries amounting in value to $2.25.

$5 − $2.25 = ? **$5.00** **2.25** **$2.75** = change	Write $5 as $5.00. Then subtract. Why were the two zeros used?

3. Subtract, as in subtracting dollars and cents:

a	*b*	*c*	*d*	*e*	*f*
5.96 mi.	4.28	6.00 lb.	9.45	$6.05	5.40 bbl.
1.75 mi.	2.09	.58 lb.	9.10	.30	.09 bbl.

In subtracting decimals, be sure to place the decimal points one under the other in a straight line. Then subtract as with United States money. Supply zeros as needed.

4. Supply zeros where needed, and subtract.

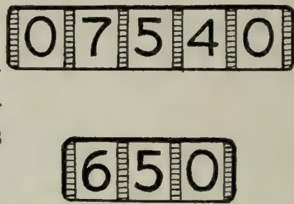
a	*b*	*c*	*d*	*e*	*f*
5.	29.1	18.	19.7	46.2	86.75
1.48	2.65	.25	8.4	21.05	28.5

5. Subtract 5.4 from each of the numbers below.

a	*b*	*c*	*d*	*e*	*f*	*g*
12.6	9	8.27	15.1	7.05	25.0	33

ON AN AUTOMOBILE TRIP

Harry and his father went on an automobile trip of 145 miles. Harry spent part of the time watching the speedometer on the car. Here is a picture of a speedometer.



1. The upper reading of the speedometer shows how far the automobile has traveled. How many miles is this?

2. The lower reading shows how far the automobile has traveled on this trip. The first two figures show miles. The figure at the right shows tenths of a mile. How far have Harry and his father gone on this trip?

3. Harry made a record of the lower readings of the speedometer at the end of each hour. Here is his record:

At start 7 A.M	0.0 miles	At 11:00	106.3 miles
At 8:00	32.6 miles	At 12:00 Noon	143.5 miles
At 9:00	59.7 miles	At 12:15 Oshkosh	145.0 miles
At 10:00	84.4 miles		

How far did they travel between 7 and 8 o'clock?

4. How far did they travel between 8 and 9? between 9 and 10? between 10 and 11? between 11 and 12:15?

5. At 10 o'clock how far were they from Oshkosh?

6. By about what time had they traveled 50 miles?

7. The 18-gallon gasoline tank was half full when they started on the trip. When they reached Oshkosh, there were still $1\frac{1}{2}$ gallons in the tank. How many gallons had they used on the trip?

8. They left Oshkosh in the afternoon at 1:40 and reached home in the evening at 6:25. How long did the return trip take?

A TEST RECORD

This is the record of six classes on an arithmetic test.

Class	Average Number Correct	Class	Average Number Correct
A	22.5	D	16.5
B	19.8	E	29.3
C	12.7	F	20.0

1. Which class had the largest number of examples correct?

2. Which class had the smallest number correct?

3. List the classes and their scores in the order of the number of examples correct. Begin with the class with the largest number correct.

4. How many more than class B did class A have correct? than class C? than class F?

5. How many more than class B did class E have correct? than class D? than class F?

PRACTICE IN ADDING AND SUBTRACTING DECIMALS

In adding and subtracting decimals be sure to place the decimal points one under the other and to place the decimal point in the answer.

Find the sum of:

1. 7.6, 8.5, 7.3, 9.0, and 4.8.

2. 1.6, 7.0, 8.3, .7, .5, and 1.0.

3. .6, .8, .5, and .3.

4. .2, .1, .3, and .2.

5. 7.5, 8.7, 9.9, and .2.

6. 8.0, .5, 96.2, and .7.

7. .85, .83, .91, and .59.

8. 1.75, 25.5, .06, and .73.

Subtract:

9. 87.2 − 26.8 =

10. 7.375 − 6.536 =

11. 86.24 − 59.47 =

12. 64. − .375 =

13. 84.3 − 26.25 =

14. 61.257 − 8.25 =

MULTIPLYING DECIMALS BY WHOLE NUMBERS

1. Harry sold 5 puppies for \$1.75 each. What did he receive for them?

5 × \$1.75 = \$8.75	You point off two places to show dollars and cents.

2. A gallon of water weighs 8.35 pounds. Find the weight of 3 gallons.

$\begin{array}{r} 8.35 \\ 3 \\ \hline 25.05 \end{array}$ $\begin{array}{r} 8.35 \\ 8.35 \\ 8.35 \\ \hline 25.05 \end{array}$	Multiply as with whole numbers. Point off as many decimal places in the product as there are decimal places in the numbers being multiplied. Count from the right. Prove that this result is correct by adding. How do you know that the answer cannot be less than 24 or as much as 27?

3. A family ate an average of 6.8 pounds of meat a week. How much did they eat in 4 weeks?

When multiplying decimals, point off as many places in the product as there are decimal places in the numbers being multiplied.

Apply this rule to the following examples:

$\begin{array}{r} 3.7 \\ 6 \\ \hline 22.2 \end{array}$ $\qquad$ $\begin{array}{r} .54 \\ 4 \\ \hline 2.16 \end{array}$ $\qquad$ $\begin{array}{r} .135 \\ 7 \\ \hline .945 \end{array}$ $\qquad$ $\begin{array}{r} 1.142 \\ 3 \\ \hline 3.426 \end{array}$

Find the products:

	a	*b*	*c*	*d*
4.	9 × 3.75 =	8 × 37.9 =	4 × 9.4 =	7 × 30.54 =
5.	6 × 73.56 =	5 × 17.7 =	9 × 8.6 =	3 × 74.96 =
6.	72 × 9.76 =	28 × 86.2 =	18 × 9.5 =	25 × 93.43 =

USING DECIMALS

The following table shows the average amount of various foods eaten in a year by each person in the United States, Great Britain, and Germany.

	United States, lb.	Great Britain, lb.	Germany, lb.
Beef and veal	68.4	64.0	39.4
Mutton and lamb	5.3	29.1	2.0
Pork products	83.8	41.6	75.5
Eggs	28.3	12.5	16.0
Milk	418.8	246.4	283.3
Butter	15.2	15.6	15.4
Wheat flour	204.7	.....	129.9
Rye flour	4.3	.....	157.8

1. In the United States there is used how much more beef and veal a person than in Great Britain? how much more than in Germany?

2. How much more milk than in Great Britain is used a person in the United States? how much more than in Germany?

3. Find the total weight of the meat products consumed a person in the United States; in Great Britain; in Germany. Which country consumes the largest amount?

4. Find the total weight of the dairy products used in each country.

5. Find the total weight of flour for the United States; for Germany. What interesting fact can you find from the table concerning the kinds of flour used in these countries?

6. Make a table showing the amount of four of these foods that would be required a year by a family of 5 in the United States; in Great Britain; in Germany.

USING DECIMALS IN MEASUREMENTS

1. Name something that is .5 foot long.

Think: .5 ft. = ? in.
$.5 \times 12 = 6.0$ in.

2. Name something that is .75 foot long.

Think: .75 ft. = $.75 \times 12$ in. = ? in.

3. Name an object about .25 foot in length.

4. Do you know any person 5.75 feet tall?

Think: 5.75 ft. = 5 ft. ? in.

5. Is a pint equal to .5 or .05 of a quart?

6. Is .5 yard equal to $\frac{1}{2}$ or $\frac{1}{4}$ of a yard?

7. Name something that weighs about .1 pound; .5 pound; 78.5 pounds.

8. 3.75 yards are equal to how many inches?

9. Which weighs the most, a .5-pound, a .45-pound, or a .25-pound ball?

10. Which is the longer, a 7-inch ribbon or one 6.5 inches in length?

11. Is .7 pound more or less than $\frac{1}{2}$ pound?

12. Is .75 gallon more or less than 3.5 quarts?

13. How many minutes are there in .5 hour? 7.5 hours?

14. Is a peck equal to .25 or .75 bushel?

15. How many quarts are there in 8.4 bushels?

16. Is this page about .75 foot or .75 yard long?

17. Name a place about .5 mile away from the school.

18. How many inches less than .75 foot is .5 foot?

19. How many pounds are there in a load of coal weighing 2.5 tons?

20. How many seconds are there in 1.5 minutes?

CHANGING DECIMALS TO FRACTIONS

Twenty-five cents may be written in decimal and common fraction form.

$$25 \text{ cents} = \$\tfrac{25}{100} = \$\tfrac{1}{4} = \$.25$$

1. Write fifty cents as a decimal, and as a common fraction.

2. Write seventy-five cents as a decimal, and as a common fraction.

In the same way .75 pound may be expressed as a common fraction.

3. .75 lb. = $\frac{75}{100}$ lb. = $\frac{3}{4}$ lb. Show that this is correct.

4. 1.25 lb. = $1\frac{\quad}{100}$ lb. = 1—— lb.

5. 1.375 qt. = $1\frac{375}{1000}$ qt. = ? qt.

Which of the following are correct?

6. 8.4 mi. = $8\frac{2}{5}$ mi.

7. 6.6 mi. = $6\frac{3}{4}$ mi.

8. 1.25 oz. = $1\frac{1}{4}$ oz.

9. 2.75 cwt. = $2\frac{3}{4}$ cwt.

10. 4.125 t. = $4\frac{1}{8}$ t.

11. 9.15 = $9\frac{3}{20}$

12. 8.45 = $8\frac{9}{20}$

13. 6.625 = $6\frac{5}{8}$

14. 5.875 = $5\frac{4}{5}$

15. 6.32 = $6\frac{8}{25}$

16. Change to mixed numbers:

4.2 lb. 3.375 mi. 9.64 t. 8.05 min.

17. Copy this table and change the decimals to fractions.

Average Yield an Acre in United States in 1919

	Bushels an Acre			Bushels an Acre	
	Decimal	Mixed Number		Decimal	Mixed Number
Barley	18.9	?	Peanuts	24.4	?
Corn	26.5	?	Rice	38.8	?
Oats	27.8	?	Rye	9.9	?
Onions	277.0	?	Wheat	12.8	?

Which form makes the more convenient table?

MULTIPLYING DOLLARS AND CENTS BY 10, 100, AND 1,000

1. Find the cost of 10 pairs of shoes if one pair costs \$4.75. 10 × \$4.75 = ?

2. Find the cost of 100 pairs of shoes at \$4.50 each. 100 × \$4.50 = ?

3. 10 × \$4.65 =	**6.** 100 × \$8.56 =	**9.** 1,000 × \$8.56 =
4. 10 × \$5.85 =	**7.** 100 × \$9.75 =	**10.** 1,000 × \$9.75 =
5. 10 × \$.65 =	**8.** 100 × \$8.64 =	**11.** 1,000 × \$8.60 =

An easier way to work these examples is to apply the following rules:

To multiply a number standing for dollars and cents by **10**, *annex one zero and move the decimal point one place to the right.* 10 × \$4.65 = \$46.50.

To multiply a number standing for dollars and cents by **100**, *annex two zeros and move the decimal point two places to the right.* 100 × \$4.65 = \$465.00.

To multiply a number standing for dollars and cents by **1,000**, *annex three zeros and move the decimal point three places to the right.* 1,000 × \$4.65 = \$4,650.00.

12. Give the products in examples **3** to **11**, using these rules.

Give the products of the following:

13. 10 × 2.5 =	**20.** 100 × 2.5 =	**27.** 1,000 × .65 =
14. 10 × .25 =	**21.** 100 × .35 =	**28.** 1,000 × 9.8 =
15. 10 × .025 =	**22.** 100 × .125 =	**29.** 1,000 × 7.36 =
16. 10 × 1.4 =	**23.** 100 × 1.36 =	**30.** 1,000 × 8.95 =
17. 10 × 1.45 =	**24.** 100 × 27.3 =	**31.** 1,000 × .76 =
18. 10 × 1.375 =	**25.** 100 × 1.675 =	**32.** 1,000 × .125 =
19. 10 × 26.5 =	**26.** 100 × 79.36 =	**33.** 1,000 × 3.75 =

34. What do 1,000 pencils cost at \$.05 each?

DIVISION OF A DECIMAL BY AN INTEGER

1. Mr. Jones bought 5 bushels of potatoes for $8.75. Find the price a bushel.

$\begin{array}{r} \$1.75 \\ 5\overline{)\$8.75} \end{array}$	Notice that the decimal point in the quotient is placed directly above the decimal point in the dividend.

2. An airplane traveled 385.71 miles in 3 hours. What was its speed an hour?

$\begin{array}{r} 128.57 \\ 3\overline{)385.71} \end{array}$	In dividing a decimal by an integer, proceed as in dividing dollars and cents. Place the decimal point in the quotient directly above the decimal point in the dividend.

Find the quotients. Be sure to place the decimal points in the answers.

3. $4\overline{)78.64}$ $5\overline{)87.5}$ $12\overline{)24.48}$ $25\overline{)46.75}$

4. In an automobile race, an auto traveled 5 miles in 3.75 minutes. Find the time a mile.

$\begin{array}{r} .75 \\ 5\overline{)3.75} \end{array}$	Notice that the answer is a decimal. How can you tell that the answer must be less than 1 minute?

Find the quotients:

5. $74\overline{)273.8}$	**8.** $32\overline{)641.92}$	**11.** $72\overline{)652.32}$	**14.** $76\overline{)412.68}$
6. $43\overline{)1565.2}$	**9.** $62\overline{)21.08}$	**12.** $73\overline{)17.739}$	**15.** $29\overline{)178.35}$
7. $12\overline{)1.452}$	**10.** $25\overline{)20.25}$	**13.** $16\overline{)6.016}$	**16.** $45\overline{)170.55}$

USE OF DECIMALS AS REMAINDERS

1. If 25 books cost \$45, find the cost of one book.

$$\begin{array}{r} \$1.80 \\ 25\overline{)\$45.00} \\ 25 \\ \hline 200 \\ 200 \\ \hline 0 \end{array}$$

The answer could have been written as $\$1\frac{20}{25}$, but this is not the common form. Therefore a decimal point was placed and two zeros were written. Division was then continued. Notice that the decimal point in the quotient was placed directly above the decimal point in the dividend. Is \$45 the same as \$45.00?

Usually answers in long division examples in which there is a remainder contain fractions with large terms. Business men change them to decimals. Study the problem below.

2. A farmer harvested 1,764 bushels of corn on a 48-acre field. What was the average number of bushels an acre?

$$36\tfrac{36}{48} = 36\tfrac{3}{4} \text{ bu.}$$

$$\begin{array}{r} 48\overline{)1{,}764} \\ 1\,44 \\ \hline 324 \\ 288 \\ \hline 36 \end{array}$$

The answer, $36\frac{36}{48}$ bushels, can be expressed as $36\frac{3}{4}$ by reducing $\frac{36}{48}$ to lowest terms.

This answer can also be expressed as a decimal by proceeding as follows:

$$\begin{array}{r} 36.75 \\ 48\overline{)1{,}764.00} \\ 1\,44 \\ \hline 324 \\ 288 \\ \hline 36\,0 \\ 33\,6 \\ \hline 2\,40 \\ 2\,40 \\ \hline \end{array}$$

Place a decimal point after 1,764 and add two zeros. Is 1,764 the same as 1,764.00? Place a decimal point in the quotient directly over the decimal point in the dividend and continue dividing.

The answer is 36.75. .75 takes the place of $\frac{3}{4}$. Is .75 equal to $\frac{3}{4}$? $\frac{75}{100} = ?$

3. $840 \div 25 =$ **4.** $317 \div 20 =$ **5.** $48\overline{)60}$ **6.** $64\overline{)112}$

Usually there is a remainder after the division has been carried out to two places. The work is then done as follows:

7. 6,658 ÷ 39 = ?

170.71 39)6,658.00 3 9 2 75 2 73 28 0 27 3 70 39 31	After the work has been carried out to two places, there is a remainder of 31. Since 31 is more than $\frac{1}{2}$ of 39, the last figure of the quotient (1) is raised to 2. The answer, therefore, is 170.72. If the last remainder had been less than $\frac{1}{2}$ of 39, the answer would have been written 170.71.

In the following examples divide. Carry the work to two decimal places. If the remainder is more than half the divisor, add 1 to the last figure in the quotient.

8. 4,953 ÷ 71 =

9. 5,964 ÷ 75 =

10. 6,472 ÷ 25 =

11. 9,843 ÷ 59 =

12. 8,697 ÷ 48 =

13. 59,846 ÷ 257 =

14. 897,634 ÷ 947 =

15. 186,952 ÷ 893 =

16. 147,853 ÷ 384 =

17. 178,462 ÷ 597 =

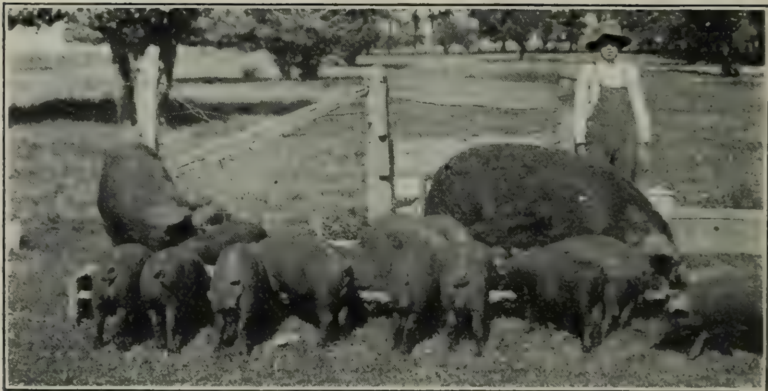
18. In six months Margaret gained 7.5 pounds. How many pounds did she gain a month on the average?

19. On a 100-acre field Mr. Smith raised 1,575 bushels of wheat. How many bushels an acre was that?

20. On a 7-acre field Mr. Jones raised 1,405 bushels of potatoes. How many bushels an acre was that?

21. An ocean liner traveled 3,200 miles in 120 hours. How many miles an hour did it travel on the average?

22. Mrs. Smith sold 8 chickens that weighed 36 pounds in all. What was their average weight?



BOYS' AND GIRLS' CLUB PROJECTS

1. Ralph's prize pig gained 169 pounds in 111 days. What was his average daily gain in weight?

2. John's prize pig gained 278 pounds in 133 days. What was his average daily gain in weight?

3. This table contains the records kept by two boys and one girl who raised calves as their projects in the club work. Each of them had to figure all of the facts which the table calls for in the report of the project.

	Date Record Began	Date Record Ended	Weight at Beginning	Weight at End	No. of Days	Gain in Weight	Average Gain a Day, lbs.
Harry..	March 15	Sept. 15	252	690	184	438	2.37
Gladys.	March 12	Sept. 15	410	810	?	?	?
Alfred..	March 14	Sept. 15	220	740	?	?	?

Copy this table neatly and find the missing numbers. In counting the number of days, do not count the day the record began, but count the last day. In figuring the gain a day, carry the work to two decimal places.

REVIEW OF IMPORTANT POINTS

This exercise will review the important points that you have learned about decimals.

1. What is meant by the decimal system?

2. How is the decimal point used in writing dollars and cents?

3. Are the figures written to the right of the decimal point of greater or less value than those written to the left of the decimal point? Prove that your answer is correct.

4. Is .06 equal to six-tenths or six-hundredths? How can you tell?

5. Show that \$4.00 is the same as \$4. Show that 4.00 feet is the same as 4 feet.

6. How must the decimal points be placed in an addition example?

7. How must the decimal points be placed in a subtraction example?

8. Why must zeros be supplied in the following subtraction examples?

47.6	96.	87.75
35.75	32.125	32.375

9. How many decimal places are there in the product of a decimal and a whole number?

10. How many decimal places must be pointed off in the product of .04 and 65?

11. Where is the decimal point placed in the quotient when a decimal is divided by a whole number?

12. How may a decimal be changed to a common fraction? Change .8 to a common fraction.

13. Show that 98 ÷ 8 equals 12.25.

14. Name something that weighs .5 pound; .5 ton; .75 ounce.

15. Name something that is .25 yard in length; 1.5 inches.

16. How many quarts are there in .125 bushel?

17. Is .8 mile more or less than .75 mile? How much?

18. Divide 300 by 48. Express the answer in the decimal form.

TEST OF DECIMALS

1. Write these words as numbers:

Four-hundredths.	One and fourteen-hundredths.
Seven and nine-tenths.	One hundred and three-tenths.
Sixteen-thousandths.	One hundred four-thousandths.
Seven-point-o-o-three.	Two-four-point-three-seven.
Four-o-o-point-o-o-four.	Point-o-nine-two-six.

2. Write these numbers in words:

.6	2.25	.175	4.03	12.035	156.75
3.2	5.017	3.226	5.4	7.682	15.007

3. Find the sum of the following:

a. 1.4 + 3.2 + 5.6 =
b. 11.91 + 36.42 + 18.95 =
c. 8.64 + 8.375 + 5.56 =

4. Subtract:

a. 37.56 − 4.85 = *c.* 499.8 − 126.35 =
b. 9.24 − 3.65 = *d.* 12 − 4.375 =

5. Find the products:

a. 9 × 47.63 = *c.* 10 × $1.56 =
b. 18 × 23.6 = *d.* 100 × 9.70 =

6. Find the quotients:

a. \$158.71 ÷ 59 = *c.* 9,840 ÷ 75 =

b. 3.375 ÷ 5 = *d.* 8,563 ÷ 39 =

PRACTICE TESTS IN THE FUNDAMENTALS

Addition Test (3 examples in 5 minutes, including checking but not copying)

1. 800	**2.** 968	**3.** 896	**4.** 958	**5.** 878	**6.** 348
746	883	559	924	467	597
592	524	987	717	974	764
953	896	415	578	653	823
792	643	964	664	763	383
848	937	425	576	396	752
319	575	686	967	486	299
527	789	788	432	399	388

Subtraction Test (4 examples in 2 minutes, including checking but not copying)

1. 140,638	**2.** 89,750	**3.** 70,104	**4.** 69,019	**5.** 77,642	**6.** 126,405
95,846	29,984	29,546	13,573	45,768	47,856

Multiplication Test (6 examples in 3 minutes, including checking but not copying)

1. 746	**2.** 589	**3.** 847	**4.** 965	**5.** 579	**6.** 864	**7.** 395	**8.** 678
49	904	508	85	67	76	32	23

Division Test (6 examples in 8 minutes, including checking but not copying)

1. 15)18,435	**4.** 85)582,675	**7.** 54)53,254	**10.** 33)217,406
2. 75)268,050	**5.** 43)254,087	**8.** 91)368,823	**11.** 82)480,602
3. 37)111,333	**6.** 45)227,700	**9.** 66)316,800	**12.** 16)69,232

PRACTICE TESTS IN FRACTIONS

If you can work each of these sets of examples correctly in six minutes, you are ready to begin sixth grade arithmetic. If you cannot work them in six minutes on your first trial, practice until you can.

Addition

1.	2.	3.	4.	5.	6.	7.
$\frac{1}{2}$	$1\frac{1}{4}$	$3\frac{1}{4}$	$2\frac{3}{8}$	$4\frac{1}{8}$	$7\frac{1}{3}$	$5\frac{1}{3}$
$\frac{1}{2}$	$\frac{1}{4}$	$3\frac{3}{4}$	$4\frac{1}{2}$	$6\frac{1}{2}$	$6\frac{1}{2}$	$6\frac{5}{6}$
$\frac{1}{2}$	$2\frac{1}{4}$	$4\frac{1}{2}$	$2\frac{3}{4}$	$4\frac{3}{8}$	$5\frac{3}{4}$	$9\frac{7}{8}$

Subtraction

1.	2.	3.	4.	5.	6.	7.
$6\frac{3}{4}$	$15\frac{1}{8}$	$16\frac{1}{4}$	$9\frac{3}{4}$	$18\frac{1}{4}$	$15\frac{3}{4}$	$29\frac{1}{8}$
$2\frac{1}{4}$	$2\frac{1}{8}$	$7\frac{2}{3}$	$2\frac{5}{8}$	$7\frac{9}{16}$	$6\frac{1}{3}$	$14\frac{1}{6}$

Multiplication

1. $4 \times \frac{2}{3} =$ **3.** $\frac{3}{4} \times 12 =$ **5.** $\frac{1}{4} \times \frac{2}{3} =$ **7.** $3\frac{1}{2} \times 5 =$

2. $6 \times 7\frac{1}{4} =$ **4.** $9 \times 5\frac{2}{3} =$ **6.** $3\frac{1}{2} \times 2\frac{2}{3} =$ **8.** $\frac{3}{8} \times 2 =$

Division

1. $7 \div \frac{1}{4} =$ **3.** $9 \div \frac{3}{5} =$ **5.** $8 \div 1\frac{1}{3} =$ **7.** $3 \div 6\frac{3}{5} =$

2. $7\frac{1}{2} \div 5 =$ **4.** $4\frac{1}{4} \div 6 =$ **6.** $8\frac{1}{4} \div 3\frac{1}{3} =$ **8.** $4\frac{1}{2} \div 6\frac{3}{4} =$

PROBLEM TESTS

Test I

1. How many square yards are there in a field 200 feet long and 180 feet wide?

2. Find the cost of $8\frac{3}{4}$ yards of cloth at \$.48 a yard.

3. Mrs. Smith bought $4\frac{1}{2}$ yards of ribbon for \$1.80. Find the price a yard.

4. Harry was paid \$.25 an hour for cutting lawns. He cut Mr. Jones' lawn in $2\frac{3}{5}$ hours and Mr. Smith's lawn in $3\frac{1}{5}$ hours. How much did he receive for cutting the two lawns?

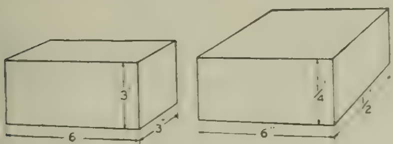
5. A train traveled 360 miles in $8\frac{1}{3}$ hours. Find the average speed in miles an hour.

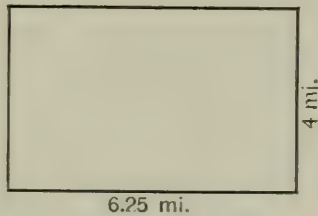
Test II

1. Find the area of this rectangle.

2. Find the perimeter of the rectangle.

3. What is the volume of each of the following?





4. Divide 893 by 78. Carry the work out to two decimal places.

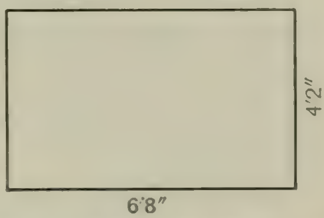
5. A railroad train traveled 34.6 miles the first hour, 37.5 miles the second hour, and 35.3 miles the third hour. What was the average number of miles an hour?

Test III

1. Find the area of this plot of ground.

2. Find the perimeter of the plot.

3. Find the cost of fencing this plot at $12\frac{1}{2}$¢ a foot.



4. Harry was reading a book containing 275 pages. He had read 125 pages in 5 hours. At that rate, how long would it take him to finish the book?

5. At an average rate of 30 miles an hour, how far can an automobile travel between 8:15 A.M. and 11:45 A.M.?

PROBLEM SCALE VII

Standards	
Excellent......	9 or 10 correct
Good..........	7 or 8 correct
Fair...........	5 or 6 correct
Unsatisfactory.	0 to 4 correct

1. Frances bought her school supplies yesterday. She paid $.10 for a notebook, $.05 for a pencil, and $.10 for a penholder. What did these supplies cost?

2. One month Dick spent $.45 for ice cream cones. How many cones did he buy if cones cost $.05 each?

3. Earl is planning to buy a bicycle. A new one costs $35.00. He can buy a good secondhand one for $24.50. How much less than the new bicycle does the used one cost?

4. Mary received $.25 last week for helping with the dishes. She spent 10 cents for a movie and put the rest of the money into her bank, in which she already had $.35. How much did she then have in her bank?

5. David and his father plan to take an 80-mile auto trip. If they average 25 miles an hour, how long will it take them to make the trip?

6. The Emerson School gave a play. Three hundred 25-cent tickets were sold. How much was left after all expenses, amounting to $8.75, had been paid?

7. Martha's mother bought $3\frac{1}{2}$ yards of silk, $4\frac{1}{2}$ yards of gingham, and $3\frac{3}{4}$ yards of linen. How many yards of cloth did she buy?

8. Mrs. Jackson bought a $12.60 lamp at a "$\frac{1}{4}$-off" sale. What did she pay for the lamp?

9. How far can an automobile go in 6 hours at the rate of 79.75 miles an hour?

10. What is the distance around a farm .75 mile long and .375 mile wide?

CHAPTER I

OUR AMERICAN SCHOOLS

1. In a recent year there were 29,345,911 boys and girls between the ages of 5 and 18 years in our country. Of these, 24,288,808 were enrolled in the schools. How many boys and girls between these ages were not in schools?

2. In that year there were 155,206 elementary-school buildings, and 4,578 high-school buildings in the United States. What was the total number of school buildings in the country that year?

3. In a recent year the average cost of educating a pupil in each of five of our leading cities was as follows:

New York	**$109.94**	**New Orleans**	**$81.05**
Philadelphia	**$88.69**	**San Francisco**	**$93.55**
Detroit	**$100.26**		

Arrange these cities in a list according to the cost of educating a pupil.

4. What was the average amount a year spent for each pupil in these five cities?

5. What would it cost to educate a class of 40 children for one year in each of the cities in the list?

6. Counting 40 weeks as a school year, what was the cost for each pupil for one week in each of these cities?

7. Counting 5 days as a school week, what was the cost a day for each pupil's schooling? Drop fractions of a cent.

TESTS IN WORKING WITH WHOLE NUMBERS

This is a test of your ability to add, subtract, multiply, and divide whole numbers. Work as many examples as you can in the time allowed. Use folded paper when possible.

Addition (2 minutes, not including copying)

1.	2.	3.	4.	5.	6.	7.	8.
34	47	98	64	85	38	87	91
37	58	77	73	85	74	97	46
26	26	75	61	69	95	65	52
79	90	64	98	65	97	43	71
58	84	43	89	23	66	13	93
92	85	57	46	18	82	35	59
61	32	19	27	29	16	76	60

Subtraction (3 minutes, not including copying)

1.	3.	5.	7.	9.	11.
475	978	842	598	828	697
168	456	395	251	149	288

2.	4.	6.	8.	10.	12.
794	939	893	1,021	1,085	846
269	756	326	353	297	449

Multiplication (5 minutes, not including copying)

1.	2.	3.	4.	5.	6.
365	472	859	967	674	825
27	56	48	93	87	59

Division (10 minutes, not including copying)

1. $26\overline{)3,822}$	4. $73\overline{)19,345}$	7. $49\overline{)31,703}$	10. $74\overline{)29,230}$
2. $52\overline{)15,860}$	5. $84\overline{)45,024}$	8. $56\overline{)54,768}$	11. $56\overline{)41,260}$
3. $35\overline{)26,180}$	6. $94\overline{)66,552}$	9. $87\overline{)32,190}$	12. $87\overline{)52,026}$

COSTS OF A CANTATA

Washington School gave a Christmas Cantata. The sixth-grade teacher was on the business committee. She asked two girls to help her to keep the accounts.

1. Miss Towne bought material for costumes as follows:

27 yd. brown cambric....@ 15¢	$3\frac{1}{8}$ yd. muslin..........@ 22¢
$6\frac{1}{2}$ yd. white cambric....@ 15¢	$4\frac{1}{2}$ yd. green cambric....@ 15¢

Find the cost of each item and the total cost of the costumes.

2. Miss Holmes sent a bill for the following items:

1 telegram ....$.56	Postage and insurance.....$.24
1 telegram .... .64	8 rolls of tinsel @ $.10..... ?
6 copies of "The Fairy's Conspiracy" @ $.60.... ?	1 roll of wire @ $.10....... ?
	6 yd. fairy curtain @ $.10. ?

Find the amount of each item and the total bill.

3. How many tickets at 25 cents each must be sold to cover the expenses of the cantata?

HOW TO SOLVE PROBLEMS

After you have read each problem carefully, answer the following questions about it. Then solve the problem and check your work.

I. What am I asked to find in the problem?

II. What facts must I know to find this?

III. Am I told these facts in the problem?

IV. How can I find the facts that I must know in order to solve the problem?

V. What do I estimate the answer to be?

1. Lemons are advertised at 2 for 10¢. At this price, what must I pay for a dozen lemons?

2. Sadie Brown bought a pound of butter at 56¢ a pound, and one and one-half pounds of coffee at 40¢ a pound. What change will she receive if she gives the grocer two one-dollar bills?

3. A remnant of cloth, $\frac{1}{2}$ yard long, sold for $1.35. At this rate what was the price of a yard?

4. At a sale, all goods were marked down to $\frac{1}{2}$ the regular price. What must I pay for $4\frac{1}{2}$ yards of silk regularly priced at $4.80 a yard?

5. After Christmas, toys were sold at $\frac{1}{3}$ of the holiday price. What did Agnes pay for a doll that was marked $5.25 before Christmas?

6. Before I started on a trip, my speedometer read 8,222 miles. On my return it read 9,182 miles. I find that I used 80 gallons of gasoline on the trip. How many miles, on the average, did my car travel on a gallon of gasoline?

7. I bought 5 gallons of gasoline at 22¢, and 2 quarts of oil at 21¢. What change did I receive from a five-dollar bill?

8. On the average, Mr. Wilson uses 28 gallons of gasoline a month. What will he save in one month on his gasoline, if the price is reduced from 23¢ a gallon to $21\frac{1}{2}$¢ a gallon?

9. A man is paid 90¢ an hour for repairing cars. He spends $3\frac{3}{4}$ hours repairing one car and $2\frac{1}{4}$ hours repairing another. How much does he earn?

10. James and his father drove to Chicago, a distance of 210 miles, at an average rate of 20 miles an hour. They came back at an average rate of 30 miles an hour. How much longer did it take them to go than to return?

ESTIMATING COSTS

Sometimes it is not convenient to find the exact cost of a number of items because the numbers used are too large, or because they are not easy to work with mentally. For instance, if you are buying 6 pounds of butter at 49¢ a pound, you know that the cost will be about 6 × 50¢, since 49¢ is about 50¢. This is a quick way of checking a bill.

1. In estimating with the following prices, what numbers would be convenient to use?

$.79 $.98 $7.96 $11.75 $198 $29.50 $3.06

Estimate mentally the cost of the following. Then check your estimate by doing the work on paper.

2. 8 crates of cherries at $7.94 a crate.

3. 24 bushels of oats at 69¢ a bushel.

4. 12 pounds of butter at 51¢ a pound.

5. 6 yards of cloth at 98¢ a yard.

6. 29 loaves of bread at 9¢ a loaf.

7. 9 pounds of coffee at 51¢ a pound, and 21 loaves of bread at 14¢ a loaf.

PRACTICE IN NAMING MORE DIFFICULT QUOTIENTS

1. An army airplane reached a height of 28,640 feet. How many miles was this?

<table>
<tr>
<td>5.42+
5,280)28,640.00
26,400
2 240 0
2 112 0
128 00
105 60
22 40</td>
<td>To find the first quotient figure think:
5
5)28
Since there will be five figures in the product of 5 × 5,280, write 5 over the 0 in 28,640.
Since there is a remainder, carry the work to two decimal places. Sometimes the work is carried to three decimal places.
Since there is a remainder after the work has been carried to two places, we write 5.42+.
28,640 ft. = 5.42 mi.</td>
</tr>
</table>

2. Mt. Everest is 29,141 feet in height. How many miles high is it?

Without pencil, name the first quotient figure in the following examples. Then work the examples.

3. 2,756)85,948 **5.** 1,574)36,845 **7.** 25,984)1,897,642

4. 3,000)184,632 **6.** 4,960)165,970 **8.** 11,250)328,597

9. On a large western farm 28,960 bushels of wheat were harvested from 1,280 acres. What was the average number of bushels an acre?

10. The Pacific Ocean is about 37,000 feet deep at its deepest point. How many miles deep is it at this point?

11. Divide 886,574 by 4,586.

BOYS' AND GIRLS' CLUBS

In all parts of the country there are boys' and girls' farm clubs. Reports of the work done by these clubs are collected by the United States Government. The results are given in the following table. Only the clubs with the largest numbers enrolled are included.

	No. Enrolled	No. Completing	Value of Products	Value for Each Person Completing
Crop				
Corn Clubs.........	35,317	17,293	$787,372	?
Cotton Clubs.......	8,830	4,459	438,899	?
Potato Clubs........	11,448	7,830	319,825	?
Fruit Clubs.........	12,174	7,045	89,659	?
Live Stock				
Swine Clubs........	51,611	28,313	1,425,002	?
Dairy Clubs........	15,381	10,473	982,172	?
Sheep Clubs........	2,204	1,524	89,265	?
Beef Clubs.........	6,139	4,453	498,398	?
Poultry Clubs.......	90,115	50,048	978,602	?
Food Preservation Clubs..	81,960	48,325	825,514	?
Clothing Textile Clubs....	148,721	94,560	647,042	?

1. Which club had the largest number enrolled? the largest number completing their projects? the largest total value of the products?

2. Make a list of the clubs, arranged in the order of the total value of the products. Begin with the club with the products of largest value.

3. For each kind of club, find the average value of the products for each person completing the work.

4. Rank the clubs in the order of the average value of the products. Begin your list with the name of the club having the product of largest average value.

5. How many boys and girls were enrolled in these clubs? How many completed the work? How many did not complete the work?

6. What was the total value of all of the products for all of the clubs?

7. In the food-preservation clubs, 2,454,665 quarts of food were canned. What was the average number of quarts for each person completing the work?

8. The clothing and textile clubs prepared 525,835 articles and garments. What was the average number of articles to a person completing the work?

9. The average yield of potatoes an acre for boys' and girls' clubs was $110\frac{1}{2}$ bushels. The United States yield was $97\frac{1}{4}$ bushels. How much less than the yield for the clubs was the yield for the United States?

10. In a recent year the number enrolled in corn, potato, cotton, and fruit clubs was 56,725. Was this more or less than the total for the same clubs in the table on page 235?

A READING TEST

Supply the missing word in each of these sentences.

1. $\frac{3}{4}$ is a —— fraction.

2. $\frac{10}{9}$ is an —— fraction.

3. $1\frac{1}{2}$ is a —— number.

4. 4 is a —— number.

5. $\frac{1}{4}$ and $\frac{3}{4}$ are —— fractions.

6. $\frac{1}{4}$ and $\frac{1}{2}$ are —— fractions.

7. When $\frac{1}{4}$ is changed to $\frac{4}{8}$ it is changed to —— terms.

8. When $\frac{6}{8}$ is changed to $\frac{3}{4}$ it is reduced to —— terms.

9. Before $\frac{1}{2}$ and $\frac{1}{4}$ can be added, they must be changed to a —— denominator.

10. To change $\frac{1}{2}$ to $\frac{4}{8}$, multiply each term by ——.

11. To reduce $\frac{8}{10}$ to $\frac{4}{5}$, —— each term by 2.

12. Inverting $\frac{3}{5}$ gives ——.

13. Inverting $2\frac{2}{3}$ gives ——.

14. Inverting 5 gives ——.

15. Before unlike fractions can be added or subtracted, they must be changed to —— fractions.

16. When changed to an improper fraction, $3\frac{7}{8}$ is equal to ——.

17. $\div\frac{5}{9}$ means the same as $\times$ ——.

18. A common denominator for $\frac{1}{2}$, $\frac{1}{3}$, and $\frac{1}{5}$ is ——.

19. Give the steps in working this example:

$16\frac{1}{8} - 3\frac{1}{2} = ?$

20. Express the following in the simplest form:

$6\frac{6}{8}$ $9\frac{4}{2}$ $12\frac{9}{6}$ $16\frac{12}{10}$ $18\frac{33}{12}$

TESTS IN FRACTIONS

If you make any mistakes in these tests, practice the sets on pages 240 and 241 which contain examples similar to those which you worked incorrectly.

Addition of Fractions (10 minutes)

1.	3.	5.	7.	9.
$\frac{5}{8}$	$\frac{1}{4}$	$\frac{1}{3}$	$5\frac{4}{5}$	$5\frac{1}{6}$
$\frac{1}{8}$	$\frac{3}{8}$	$\frac{3}{4}$	6	$3\frac{1}{4}$
$\frac{3}{8}$	$\frac{1}{8}$	$\frac{5}{6}$	$7\frac{1}{5}$	$2\frac{1}{2}$

2.	4.	6.	8.	10.
$\frac{3}{5}$	$\frac{2}{3}$	$1\frac{1}{6}$	$6\frac{2}{3}$	$8\frac{1}{4}$
$\frac{3}{5}$	$\frac{1}{6}$	$2\frac{5}{6}$	$5\frac{2}{3}$	$7\frac{4}{5}$
$\frac{4}{5}$	$\frac{1}{12}$	$2\frac{1}{6}$	$9\frac{2}{3}$	$5\frac{5}{6}$

Subtraction of Fractions (10 minutes)

1.	3.	5.	7.	9.
$\frac{9}{10}$	$\frac{3}{5}$	$\frac{3}{4}$	$5\frac{1}{3}$	$9\frac{1}{4}$
$\frac{3}{10}$	$\frac{3}{10}$	$\frac{2}{3}$	$2\frac{2}{3}$	$7\frac{5}{6}$

2.	4.	6.	8.	10.
2	4	$3\frac{1}{4}$	$8\frac{1}{4}$	$13\frac{2}{3}$
$\frac{3}{4}$	$3\frac{1}{3}$	$1\frac{3}{4}$	$3\frac{7}{8}$	$8\frac{4}{5}$

Multiplication of Fractions (10 minutes)

1. $\frac{2}{3} \times 8 =$	5. $3 \times 2\frac{1}{2} =$	9. $6\frac{2}{3} \times 72 =$
2. $2 \times \frac{5}{12} =$	6. $7\frac{1}{2} \times \frac{1}{5} =$	10. $\frac{4}{5} \times \frac{7}{8} \times 3\frac{1}{3} =$
3. $\frac{1}{3} \times \frac{1}{3} =$	7. $\frac{1}{8} \times 1\frac{1}{2} =$	11. $7\frac{7}{8} \times 616 =$
4. $\frac{3}{4} \times \frac{8}{9} =$	8. $2\frac{2}{3} \times 1\frac{1}{8} =$	12. $4\frac{1}{2} \times 7\frac{1}{6} \times 8 =$

Division of Fractions (10 minutes)

1. $4 \div \frac{1}{8} =$	5. $5\frac{1}{4} \div \frac{7}{10} =$	9. $7\frac{1}{2} \div 15 =$
2. $6 \div \frac{3}{4} =$	6. $6 \div 4\frac{1}{2} =$	10. $6\frac{2}{3} \div 3\frac{3}{4} =$
3. $\frac{1}{2} \div \frac{1}{6} =$	7. $3 \div 6\frac{2}{3} =$	11. $1\frac{1}{6} \div 7 =$
4. $\frac{3}{4} \div \frac{7}{8} =$	8. $7\frac{1}{5} \div 6 =$	12. $180 \div 6\frac{2}{3} =$

HOW OUR FARM LAND IS USED

The Department of Agriculture makes a report each year showing the use that is made of the crop land in each of the states. The table below shows the fraction of the area of each state that is used for wheat, hay, and forage.

	Wheat	Hay and Forage	Part Used for Wheat, Hay, and Forage	Part Used for Other Purposes
Kansas	$\frac{1}{2}$	$\frac{1}{4}$	?	?
South Dakota	$\frac{1}{4}$	$\frac{1}{3}$	?	?
Idaho	$\frac{2}{5}$	$\frac{2}{5}$	?	?
Virginia	$\frac{1}{6}$	$\frac{1}{6}$	?	?

1. What fraction of the crop land in Kansas was used for wheat? for forage?

2. What fraction of the crop land was used for these two purposes in Kansas?

3. What fraction of the crop land was used for these two purposes in each of the other states?

4. If $\frac{3}{4}$ of the crop land in Kansas was used for wheat and forage, what fraction was used for other purposes?

5. What fraction of the land is used for other purposes in each of the states?

6. One year a Kansas farmer raised 636 bushels of wheat on a 24-acre field. What was the average number of bushels an acre?

7. One year the average number of bushels of wheat an acre in the United States was $12\frac{4}{5}$ bushels. A South Dakota farmer raised 525 bushels on 35 acres. How many bushels an acre more than the average did he raise?

PRACTICE IN CHANGING THE FORM OF A NUMBER

What is the missing numerator in each case?

1. $1\frac{1}{2} = 1\frac{}{4} = 1\frac{}{6} = 1\frac{}{8} = 1\frac{}{10} = 1\frac{}{12} = 1\frac{}{16}$
2. $1\frac{3}{4} = 1\frac{}{8} = 1\frac{}{16} = 1\frac{}{12} = 1\frac{}{24}$
3. $1\frac{1}{4} = \frac{}{4} = \frac{}{8} = \frac{}{16} = \frac{}{12} = \frac{}{24}$
4. $1\frac{1}{2} = \frac{}{2} = \frac{}{4} = \frac{}{6} = \frac{}{10} = \frac{}{24}$
5. $4\frac{2}{5} = 3\frac{}{5} = 3\frac{}{10} = 3\frac{}{20} = 3\frac{}{15} = 3\frac{}{100}$
6. $2\frac{1}{2} = 1\frac{}{2} = 1\frac{}{4} = 1\frac{}{6} = 1\frac{}{8} = 1\frac{}{10}$
7. $5\frac{3}{2} = 6\frac{}{2}$
8. $6\frac{8}{5} = 7\frac{}{5}$
9. $7\frac{4}{3} = 8\frac{}{3}$
10. $9\frac{5}{4} = 10\frac{}{4}$
11. $7\frac{11}{8} = 8\frac{}{8}$
12. $6\frac{9}{6} = 7\frac{}{6} = 7\frac{}{2}$
13. $5\frac{3}{2} = 5\frac{}{4} = 5\frac{}{6} = 5\frac{}{8}$
14. $6\frac{5}{4} = 6\frac{}{16} = 6\frac{}{8} = 6\frac{}{12}$
15. $4\frac{1}{3} = 3\frac{}{6} = 3\frac{}{9}$
16. $8\frac{1}{2} = 7\frac{}{4} = 7\frac{}{8}$
17. $9\frac{10}{8} = 10\frac{}{8} = 10\frac{}{4}$
18. $6\frac{5}{3} = 7\frac{}{3}$

Reduce these numbers to simplest form.

19. $6\frac{5}{4} =$
20. $8\frac{9}{6} =$
21. $6\frac{6}{4} =$
22. $8\frac{12}{8} =$
23. $1\frac{14}{7} =$
24. $6\,\frac{4}{2} =$
25. $6\frac{8}{12} =$
26. $9\,\frac{7}{5} =$
27. $8\frac{15}{10} =$
28. $\frac{17}{4} =$
29. $\frac{28}{12} =$
30. $\frac{75}{125} =$

PRACTICE IN ADDITION OF FRACTIONS

Practice these sets of addition examples in fractions until you can find the answers quickly and accurately. Keep a record of your time on three trials of each set.

Set I

$\frac{1}{4}$	$\frac{1}{3}$	$\frac{3}{5}$	$\frac{5}{6}$	$\frac{2}{3}$	$\frac{3}{4}$	$\frac{5}{8}$
$\frac{1}{4}$	$\frac{2}{3}$	$\frac{4}{5}$	$\frac{5}{6}$	$\frac{2}{3}$	$\frac{1}{4}$	$\frac{7}{8}$
				$\frac{2}{3}$	$\frac{1}{4}$	$\frac{5}{8}$

$\frac{3}{8} + \frac{1}{8} =$ $\frac{7}{10} + \frac{8}{10} =$ $\frac{9}{10} + \frac{1}{10} =$ $\frac{7}{9} + \frac{7}{9} + \frac{5}{9} =$

Set II

$\frac{3}{4}$	$\frac{5}{6}$	$\frac{4}{5}$	$\frac{5}{12}$	$\frac{9}{10}$	$\frac{2}{3}$	$\frac{2}{3}$
$\frac{1}{8}$	$\frac{1}{3}$	$\frac{3}{4}$	$\frac{1}{4}$	$\frac{3}{5}$	$\frac{3}{8}$	$\frac{4}{5}$
						$\frac{3}{8}$

$\frac{5}{6}+\frac{1}{8}=$ $\quad$ $\frac{5}{6}+\frac{1}{4}+\frac{7}{8}=$ $\quad$ $\frac{3}{4}+\frac{5}{6}=$ $\quad$ $\frac{1}{6}+\frac{7}{8}=$

Set III

$1\frac{1}{2}$	$2\frac{1}{4}$	$5\frac{7}{8}$	$4\frac{5}{9}$	$6\frac{4}{5}$	$8\frac{1}{3}$	$9\frac{7}{10}$
$\frac{1}{2}$	$3\frac{1}{4}$	$6\frac{1}{8}$	$3\frac{7}{9}$	$3\frac{3}{5}$	$6\frac{2}{3}$	$8\frac{6}{10}$
					$7\frac{1}{3}$	$3\frac{7}{10}$

$4+\frac{1}{5}=$ $\quad$ $2\frac{2}{3}+3+1\frac{2}{3}=$ $\quad$ $8+\frac{1}{4}+3\frac{3}{4}=$ $\quad$ $1\frac{1}{4}+4=$

Set IV

$6\frac{2}{3}$	$\frac{7}{8}$	$3\frac{1}{5}$	$7\frac{1}{2}$	$4\frac{3}{8}$	$9\frac{3}{4}$	$\frac{1}{3}$
$\frac{1}{4}$	$9\frac{3}{4}$	$2\frac{2}{3}$	$4\frac{5}{6}$	$2\frac{5}{6}$	$4\frac{1}{10}$	$6\frac{3}{4}$
						$4\frac{5}{6}$

$3\frac{1}{5}+2\frac{2}{5}+4\frac{2}{5}=$ $\quad$ $4\frac{1}{6}+5\frac{11}{12}=$ $\quad$ $3\frac{1}{3}+2\frac{5}{6}=$

Set V

$\frac{4}{5}$	$\frac{5}{6}$	$4\frac{1}{2}$	$\frac{4}{5}$	$\frac{8}{15}$	$7\frac{7}{8}$	$2\frac{2}{3}$
$\frac{1}{5}$	$7\frac{5}{6}$	$6\frac{7}{8}$	$\frac{9}{10}$	$7\frac{2}{5}$	$8\frac{1}{4}$	4
					$5\frac{5}{6}$	$9\frac{7}{8}$

$5\frac{1}{4}+6\frac{1}{12}=$ $\quad$ $5\frac{9}{10}+3\frac{1}{3}=$ $\quad$ $8\frac{5}{6}+2\frac{1}{3}=$ $\quad$ $8\frac{1}{4}+6\frac{1}{8}=$

Set VI

$\frac{1}{4}$	$\frac{1}{3}$	$1\frac{1}{2}$	$1\frac{3}{4}$	$7\frac{7}{8}$	$9\frac{4}{5}$	$4\frac{2}{3}$
$\frac{1}{2}$	$\frac{3}{4}$	3	$2\frac{1}{2}$	$6\frac{3}{4}$	$6\frac{1}{2}$	$3\frac{1}{2}$
$\frac{7}{8}$	$\frac{5}{6}$	$2\frac{1}{2}$	$3\frac{1}{4}$	$5\frac{1}{2}$	$8\frac{9}{10}$	$7\frac{7}{8}$

SOME INDIVIDUAL GROWTH RECORDS

Here are the height and weight records of four children for a period of 18 weeks.

	Polly O.		John H.		Dorothy H.		Charles W.	
	Height (Inches)	*Weight* (Pounds)	*Height* (Inches)	*Weight* (Pounds)	*Height* (Inches)	*Weight* (Pounds)	*Height* (Inches)	*Weight* (Pounds)
Oct. 23...	$47\frac{1}{4}$	$52\frac{1}{2}$	$47\frac{1}{4}$	$53\frac{3}{4}$	$53\frac{1}{4}$	$72\frac{1}{4}$	$53\frac{1}{4}$	72
Dec. 5...	$47\frac{1}{2}$	$53\frac{1}{4}$	$47\frac{1}{2}$	$54\frac{1}{2}$	$53\frac{1}{4}$	$73\frac{1}{2}$	$53\frac{1}{2}$	$72\frac{3}{4}$
Feb. 27...	48	$54\frac{1}{2}$	$47\frac{1}{2}$	56	$53\frac{1}{2}$	76	54	$74\frac{1}{2}$

1. Which child made the largest growth in height between October 23 and February 27?

2. Which child made the largest total growth in weight?

3. Rank the children in the order of the amount of total gain in height. Make a list of the names, beginning with the child that made the largest gain. Give the gains.

4. Rank the children in the order of the amount of gain in weight. Give the gain for each child. Were the ranks for both height and weight the same?

***5.** Find the amount of growth in height and weight for each child during each interval. Use the form of the table below to make the report of the results.

RECORD OF GROWTHS

Periods	Polly		John		Dorothy		Charles	
	Height	*Weight*	*Height*	*Weight*	*Height*	*Weight*	*Height*	*Weight*
Oct. to Dec.........								
Dec. to Feb.........								
Total Growth.....								

ZERO DIFFICULTIES IN SUBTRACTION OF FRACTIONS

1. Harry had $5\frac{3}{4}$ bushels of walnuts. He sold all but $1\frac{3}{4}$ bushels. How many bushels did he sell?

	Think: $5\frac{3}{4}$ bu. $-$ $1\frac{3}{4}$ bu. = ?
$5\frac{3}{4}$ bu.	$\frac{3}{4} - \frac{3}{4} = 0$. Do not write zero.
$-1\frac{3}{4}$ bu.	$5 - 1 = 4$. Write 4.
4 bu.	Harry sold 4 bu. of walnuts.

Some of the examples below contain zero difficulties in subtraction. Work them carefully. If you make any mistakes, be sure that you find why your work is incorrect.

2. $4\frac{2}{3}$ $\frac{1}{3}$	**8.** 7 $\frac{1}{3}$	**14.** $8\frac{2}{3}$ $\frac{2}{3}$	**20.** $7\frac{1}{4}$ $\frac{3}{4}$	**26.** $2\frac{5}{8}$ $2\frac{1}{8}$	**32.** 9 $3\frac{1}{5}$
3. $7\frac{1}{5}$ $\frac{3}{5}$	**9.** $6\frac{1}{2}$ 3	**15.** $4\frac{5}{6}$ $\frac{1}{3}$	**21.** 4 $3\frac{7}{12}$	**27.** $\frac{1}{4}$ $\frac{2}{8}$	**33.** $8\frac{1}{4}$ $7\frac{3}{4}$
4. 4 $1\frac{1}{8}$	**10.** $3\frac{7}{8}$ $\frac{1}{2}$	**16.** $\frac{1}{8}$ $\frac{1}{8}$	**22.** 1 $\frac{7}{8}$	**28.** $5\frac{1}{5}$ $2\frac{4}{5}$	**34.** $7\frac{1}{4}$ $\frac{2}{5}$
5. $7\frac{5}{6}$ $\frac{1}{6}$	**11.** $4\frac{1}{4}$ $\frac{5}{8}$	**17.** $9\frac{3}{5}$ $8\frac{4}{5}$	**23.** $1\frac{1}{10}$ $\frac{4}{5}$	**29.** $7\frac{1}{2}$ $5\frac{4}{8}$	**35.** $19\frac{1}{2}$ $18\frac{2}{3}$
6. $9\frac{7}{8}$ $9\frac{3}{4}$	**12.** $3\frac{1}{3}$ $3\frac{1}{3}$	**18.** $1\frac{1}{2}$ $\frac{5}{6}$	**24.** $13\frac{1}{4}$ $12\frac{5}{8}$	**30.** $1\frac{5}{6}$ $1\frac{1}{2}$	**36.** $\frac{1}{7}$ $\frac{1}{7}$
7. $19\frac{1}{8}$ 19	**13.** $8\frac{1}{2}$ $\frac{2}{3}$	**19.** $8\frac{1}{2}$ $8\frac{1}{3}$	**25.** $2\frac{1}{6}$ $\frac{2}{3}$	**31.** $2\frac{3}{8}$ $\frac{1}{3}$	**37.** $6\frac{3}{8}$ $4\frac{1}{8}$

38. Mrs. Smith had a piece of cloth $8\frac{1}{4}$ yards in length. She cut off a piece $3\frac{1}{4}$ yards long. How long was the remaining piece of cloth?

PRACTICE IN SUBTRACTION OF FRACTIONS

Practice these sets of subtraction examples until you can find the answers quickly and accurately. Keep a record of the time in which you can complete each set for three trials.

Set I

$\frac{4}{5}$	$\frac{3}{4}$	$\frac{11}{15}$	1	$\frac{7}{8}$	3	8
$\frac{1}{5}$	$\frac{1}{4}$	$\frac{2}{15}$	$\frac{2}{3}$	$\frac{7}{8}$	$1\frac{2}{3}$	$2\frac{2}{3}$

Set II

$\frac{4}{5}$	$\frac{2}{3}$	$\frac{1}{2}$	$\frac{1}{4}$	$\frac{2}{3}$	$\frac{3}{4}$	$\frac{7}{8}$
$\frac{1}{10}$	$\frac{1}{4}$	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{3}{4}$

Set III

$3\frac{7}{8}$	$5\frac{5}{6}$	$2\frac{3}{4}$	$8\frac{3}{5}$	$4\frac{9}{10}$	$9\frac{3}{8}$	$5\frac{11}{12}$
$\frac{1}{8}$	$1\frac{1}{6}$	$2\frac{1}{4}$	$8\frac{1}{5}$	$2\frac{7}{10}$	$7\frac{1}{8}$	$4\frac{5}{12}$

Set IV

$7\frac{1}{8}$	$6\frac{5}{9}$	$4\frac{1}{4}$	$8\frac{1}{3}$	$18\frac{3}{5}$	$14\frac{11}{15}$	$6\frac{1}{6}$
$\frac{3}{8}$	$2\frac{7}{9}$	$3\frac{3}{4}$	$7\frac{2}{3}$	$9\frac{4}{5}$	$9\frac{13}{15}$	$4\frac{5}{6}$

Set V

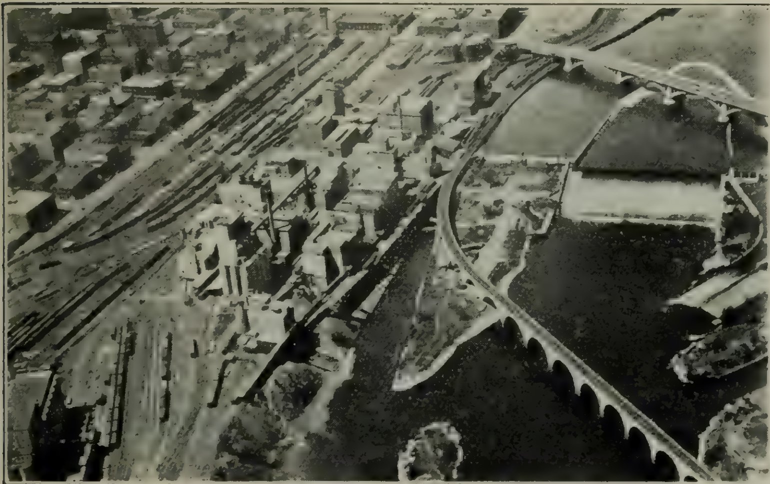
$7\frac{2}{3}$	$9\frac{7}{8}$	$7\frac{11}{12}$	$14\frac{4}{5}$	$9\frac{9}{10}$	$8\frac{1}{2}$	$7\frac{1}{4}$
$3\frac{1}{4}$	$6\frac{1}{2}$	$2\frac{1}{6}$	$14\frac{3}{8}$	$3\frac{1}{3}$	$6\frac{1}{3}$	$7\frac{1}{8}$

Set VI

$7\frac{1}{3}$	$7\frac{5}{6}$	$9\frac{1}{2}$	$12\frac{1}{3}$	$8\frac{7}{10}$	$4\frac{3}{4}$	$6\frac{3}{5}$
$4\frac{3}{4}$	$3\frac{11}{12}$	$8\frac{3}{4}$	$11\frac{5}{6}$	$7\frac{4}{5}$	$2\frac{5}{6}$	$2\frac{9}{10}$

Set VII

3	$6\frac{1}{2}$	$9\frac{1}{8}$	$17\frac{4}{5}$	$7\frac{4}{5}$	$9\frac{11}{12}$	$18\frac{1}{3}$
$1\frac{2}{3}$	$2\frac{1}{4}$	$8\frac{1}{3}$	$2\frac{9}{10}$	$1\frac{1}{10}$	$9\frac{3}{4}$	$9\frac{7}{8}$



THE OUTPUT OF ONE FLOUR MILL

1. In one of the great flour mills at Minneapolis 36,000 barrels of flour are manufactured a day. How many pounds of flour is this? (196 lb. = 1 bbl.)

2. Four and three-fourths bushels of wheat are required for one barrel of flour. How many bushels of wheat are required for the mill for one day?

3. The average yield of wheat is about 15 bushels an acre. How many acres will produce enough wheat for this flour mill for a day? for a week (6 days)? for a year?

4. How many 160-acre farms are required to supply the wheat for one day's production? one week's production? one year's production?

5. Wheat weighs 60 pounds a bushel. Find the weight of the wheat required for one barrel of flour. How much more than the weight of the flour is the weight of the wheat?

6. A car load of wheat averages about 1,200 bushels. How many car loads of wheat are used a day?

7. About 270 one-pound loaves of bread may be made from one barrel of flour. Find the number of one-pound loaves that can be made from the flour produced in one day by this mill.

8. The average value of a bushel of wheat exported from the United States in a recent year was $1.43. At this rate what was the value of the wheat required to make a barrel of flour?

***9.** If a barrel of flour cost a baker $9.75, what was the value of the flour used to make a one-pound loaf of bread?

***10.** Which is cheaper, to buy flour by the barrel at $9.80 or by the 49-pound sack at $2.52?

PRACTICE IN MULTIPLICATION OF FRACTIONS

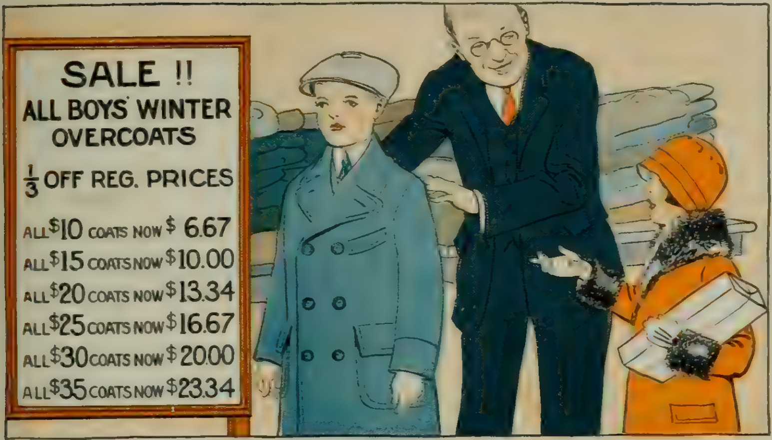
Practice these sets of multiplication examples until you can find the answers quickly and accurately.

Set I

	a	*b*	*c*	*d*
1.	$\frac{1}{3} \times 2 =$	$\frac{1}{4} \times 3 =$	$\frac{7}{8} \times 4 =$	$\frac{4}{5} \times 10 =$
2.	$\frac{8}{9} \times 3 =$	$3 \times \frac{1}{4} =$	$4 \times \frac{1}{5} =$	$7 \times \frac{2}{3} =$
3.	$\frac{1}{4} \times \frac{1}{4} =$	$\frac{1}{3} \times \frac{2}{3} =$	$\frac{7}{8} \times \frac{3}{4} =$	$\frac{4}{5} \times \frac{5}{6} =$
4.	$\frac{8}{9} \times \frac{3}{4} =$	$\frac{2}{4} \times \frac{3}{4} =$	$\frac{4}{9} \times \frac{3}{8} =$	$\frac{9}{10} \times \frac{5}{6} =$

Set II

1.	$2\frac{1}{2} \times 2 =$	$3\frac{1}{3} \times 3 =$	$4\frac{1}{4} \times 5 =$	$7\frac{1}{8} \times 6 =$
2.	$2\frac{1}{3} \times 5 =$	$3 \times 6\frac{1}{4} =$	$9 \times 8\frac{1}{10} =$	$12 \times 3\frac{2}{3} =$
3.	$2\frac{1}{2} \times \frac{1}{4} =$	$7\frac{1}{3} \times \frac{2}{3} =$	$5\frac{5}{6} \times \frac{5}{7} =$	$9\frac{1}{4} \times \frac{4}{5} =$
4.	$7\frac{1}{5} \times \frac{10}{27} =$	$\frac{7}{9} \times 3\frac{3}{5} =$	$\frac{4}{5} \times 6\frac{1}{4} =$	$\frac{2}{3} \times 5\frac{1}{4} =$



This advertisement appeared in a daily paper.

1. Check over the figures and see if exactly $\frac{1}{3}$ is taken off.

2. If $\frac{1}{3}$ is taken off the regular price, what fraction of the regular price is the sale price?

3. Albert bought a \$25 overcoat at the advertised price. What change did he get from a twenty-dollar bill?

4. Albert noticed some handkerchiefs marked to sell at 35¢. If the handkerchiefs were regularly priced at 50¢; what was the reduction on 10 handkerchiefs?

5. How much will Albert save if he buys a half dozen 30¢ handkerchiefs at the sale price of $\frac{1}{3}$ off?

6. The merchant tells him that the neckties are priced at $\frac{1}{3}$ off. Make a table like the one above showing the regular and sale prices of neckties regularly priced at 50¢, 75¢; \$1.00; \$1.25; \$1.50; and \$2.00.

7. A store advertised its women's fall coats at $\frac{1}{4}$ off. The coats were marked at \$12, \$15, \$18, \$21, \$30, and \$54. Find the regular prices of these coats.

IMPORTANT POINTS ABOUT DIVISION OF FRACTIONS

It is easy to divide by fractions if you always remember to invert the divisor and then to multiply. Study the following work carefully.

1. How many pieces of ribbon $\frac{3}{4}$ yard long can be cut from a ribbon $4\frac{1}{2}$ yards long?

$4\frac{1}{2} \div \frac{3}{4} = ?$ $\frac{\overset{3}{\cancel{9}}}{\cancel{2}} \times \frac{\overset{2}{\cancel{4}}}{\cancel{3}} = 6$	Change $4\frac{1}{2}$ to an improper fraction. Change $\div$ to $\times$. Invert $\frac{3}{4}$. Then multiply.

2. Mary wishes to cut a ribbon $4\frac{1}{2}$ yards long into three equal pieces. How long will each piece be?

$4\frac{1}{2} \div 3 = ?$ $\frac{9}{2} \div \frac{3}{1} = \frac{\overset{3}{\cancel{9}}}{2} \times \frac{1}{\cancel{3}} = \frac{3}{2} = 1\frac{1}{2}$	Remember that 3 is the same as $\frac{3}{1}$. The inverted form of 3 or $\frac{3}{1}$ is $\frac{1}{3}$. Each piece will be $1\frac{1}{2}$ yards long.

3. Alice has 6 yards of ribbon which she wishes to cut into pieces $1\frac{1}{2}$ yards long. How many pieces will she have?

$6 \div 1\frac{1}{2} = ?$ $6 \div \frac{3}{2} = \overset{2}{\cancel{6}} \times \frac{2}{\cancel{3}} = 4$	Change $1\frac{1}{2}$ to an improper fraction. Then invert and multiply. Alice will have 4 pieces.

Supply the missing numbers in the following and find the answers:

4. $1\frac{1}{2} \div \frac{3}{4} = \frac{3}{2} \times — = ?$
5. $4\frac{1}{3} \div \frac{1}{3} = \frac{13}{3} \times — = ?$
6. $3 \div \frac{2}{3} = 3 \times — = ?$
7. $7\frac{1}{2} \div 2\frac{1}{2} = \frac{15}{2} \times — = ?$
8. $7\frac{1}{2} \div 5 = \frac{15}{2} \times — = ?$
9. $2\frac{1}{2} \div 10 = \frac{5}{2} \times — = ?$
10. $4\frac{4}{5} \div 6 = \frac{24}{5} \times — = ?$
11. $\frac{2}{3} \div \frac{2}{3} = \frac{2}{3} \times — = ?$
12. $\frac{7}{8} \div \frac{1}{8} = \frac{7}{8} \times — = ?$
13. $\frac{1}{2} \div \frac{3}{4} = \frac{1}{2} \times — = ?$
14. $6\frac{2}{3} \div 3\frac{1}{8} = \frac{20}{3} \times — = ?$
15. $8\frac{1}{3} \div 1\frac{2}{3} = \frac{25}{3} \times — = ?$
16. $1\frac{1}{3} \div 6 = \frac{4}{3} \times — = ?$
17. $5 \div 12\frac{1}{2} = 5 \times — = ?$

PRACTICE IN DIVISION OF FRACTIONS

Practice these sets of division examples until you can find the answers quickly and accurately. Keep a record of your time on three trials of each set.

Set I

	a	*b*	*c*	*d*
1.	$1 \div \frac{1}{2} =$	$3 \div \frac{2}{3} =$	$7 \div \frac{5}{6} =$	$6 \div \frac{2}{3} =$
2.	$3 \div \frac{1}{5} =$	$8 \div \frac{4}{5} =$	$16 \div \frac{7}{8} =$	$20 \div \frac{10}{11} =$

Set II

1.	$\frac{1}{4} \div \frac{1}{8} =$	$\frac{1}{3} \div \frac{5}{6} =$	$\frac{2}{3} \div \frac{3}{4} =$	$\frac{7}{8} \div \frac{1}{2} =$
2.	$\frac{1}{2} \div \frac{3}{4} =$	$\frac{9}{10} \div \frac{3}{5} =$	$\frac{4}{5} \div \frac{1}{2} =$	$\frac{15}{16} \div \frac{5}{3} =$

Set III

1.	$3\frac{1}{2} \div \frac{1}{4} =$	$4\frac{1}{2} \div \frac{3}{4} =$	$8\frac{2}{3} \div \frac{4}{5} =$	$4\frac{4}{5} \div \frac{6}{7} =$
2.	$2\frac{1}{2} \div \frac{1}{2} =$	$5\frac{1}{2} \div \frac{3}{4} =$	$3\frac{1}{3} \div \frac{1}{3} =$	$12\frac{1}{2} \div \frac{5}{6} =$

Set IV

1.	$4 \div 2\frac{1}{2} =$	$8 \div 2\frac{2}{3} =$	$7 \div 11\frac{1}{5} =$	$9 \div 3\frac{3}{7} =$
2.	$12 \div 6\frac{2}{3} =$	$5 \div 6\frac{1}{4} =$	$8 \div 3\frac{1}{3} =$	$2 \div 2\frac{2}{9} =$

Set V

1.	$6\frac{1}{2} \div 2\frac{1}{2} =$	$4\frac{2}{3} \div 9\frac{1}{3} =$	$6\frac{2}{3} \div 1\frac{1}{4} =$	$6\frac{1}{2} \div 9\frac{3}{4} =$
2.	$3\frac{1}{3} \div 6\frac{2}{3} =$	$7\frac{7}{8} \div 3\frac{1}{8} =$	$6\frac{2}{3} \div 3\frac{1}{3} =$	$1\frac{1}{2} \div 4\frac{1}{2} =$

Set VI

1.	$\frac{1}{2} \div 4 =$	$\frac{3}{4} \div 6 =$	$\frac{7}{8} \div 5 =$	$\frac{9}{10} \div 6 =$
2.	$\frac{1}{6} \div 2 =$	$\frac{5}{6} \div 5 =$	$\frac{11}{12} \div 2 =$	$\frac{14}{15} \div 7 =$

Set VII

1.	$3\frac{1}{2} \div 2 =$	$4\frac{1}{2} \div 3 =$	$6\frac{2}{3} \div 10 =$	$8\frac{1}{3} \div 5 =$
2.	$1\frac{7}{8} \div 5 =$	$12\frac{1}{2} \div 25 =$	$9\frac{3}{4} \div 13 =$	$13\frac{1}{3} \div 4 =$

Set VIII

1.	$3 \div \frac{2}{3} =$	$\frac{9}{10} \div 6 =$	$6\frac{2}{3} \div \frac{2}{3} =$	$9 \div 16\frac{2}{3} =$
2.	$5 \div 1\frac{2}{3} =$	$8\frac{7}{8} \div 4\frac{1}{2} =$	$\frac{1}{8} \div \frac{1}{16} =$	$1\frac{1}{9} \div 3\frac{1}{3} =$

ON A DAIRY FARM

Dick and Donald live on a dairy farm. Their father told them to weigh the milk that three of their cows gave for four days. This is the record the boys made:

	Molly	Sue	Daisy	Totals by Days
Monday	$24\frac{1}{4}$ lb.	$30\frac{1}{8}$ lb.	$25\frac{1}{2}$ lb.	?
Tuesday	$24\frac{1}{2}$ lb.	$31\frac{3}{4}$ lb.	$25\frac{1}{8}$ lb.	?
Wednesday	$23\frac{7}{8}$ lb.	31 lb.	$24\frac{3}{8}$ lb.	?
Thursday	$24\frac{1}{8}$ lb.	$31\frac{3}{8}$ lb.	$25\frac{1}{4}$ lb.	?
Totals	?	?	?	?

1. On what day did Molly give the most milk? Sue? Daisy?

2. How much more milk than Molly did Sue give on Monday? how much more than Daisy?

3. How much more than Molly did Daisy give on Monday?

4. Copy the boys' record and fill in the blanks.

5. What was the average yield of each cow a day during the four days?

6. If Molly gave as much milk each day for 7 days as she did on Tuesday, how many pounds would she give?

7. If Sue gave as much milk each day for 6 days as she gave on Thursday, how many pounds would she give?

8. There are 2 pounds of milk in a quart. How many quarts of milk did each of the cows yield on each of the four days? You can show this by making a table like the one for pounds, but write quarts for pounds.

FRACTION REVIEW

Use this table for review work with fractions. Do all of the work you can mentally.

I. Add the number in the last column at the right to the numbers in each row.

II. Subtract the number in the last column from the numbers in each row.

III. Multiply the numbers in each row by the number in the last column.

IV. Divide the numbers in each row by the number in the last column.

1.	$\frac{3}{8}$	$\frac{5}{8}$	$\frac{1}{4}$	$\frac{1}{2}$	$\frac{7}{8}$	$\frac{3}{4}$	$1\frac{1}{2}$	$2\frac{1}{4}$	$3\frac{3}{8}$	$\frac{1}{8}$
2.	$\frac{2}{9}$	$\frac{1}{3}$	$\frac{4}{9}$	$\frac{5}{9}$	$\frac{2}{3}$	$\frac{8}{9}$	$\frac{7}{9}$	$1\frac{1}{3}$	$2\frac{2}{9}$	$\frac{1}{9}$
3.	$\frac{3}{10}$	$\frac{7}{10}$	$\frac{1}{5}$	$\frac{9}{10}$	$\frac{2}{5}$	$\frac{1}{2}$	$\frac{4}{5}$	$2\frac{1}{10}$	$2\frac{2}{5}$	$\frac{1}{10}$
4.	$\frac{3}{4}$	$\frac{5}{6}$	$\frac{2}{3}$	$\frac{7}{8}$	$\frac{4}{5}$	$\frac{6}{7}$	$\frac{8}{9}$	$1\frac{1}{2}$	$2\frac{3}{4}$	$\frac{2}{3}$
5.	$\frac{9}{10}$	$\frac{7}{8}$	$\frac{5}{8}$	$\frac{15}{16}$	$\frac{13}{16}$	$\frac{11}{16}$	$\frac{9}{16}$	$1\frac{3}{8}$	$2\frac{3}{4}$	$\frac{3}{8}$
6.	$4\frac{1}{2}$	$2\frac{2}{3}$	5	6	$3\frac{1}{5}$	$3\frac{3}{8}$	3	9	$3\frac{3}{4}$	$2\frac{2}{3}$
7.	$5\frac{1}{2}$	$3\frac{1}{4}$	$4\frac{3}{4}$	$2\frac{1}{8}$	$3\frac{1}{2}$	$4\frac{3}{8}$	$2\frac{5}{8}$	$4\frac{7}{8}$	$7\frac{1}{8}$	$1\frac{3}{4}$
8.	$1\frac{1}{2}$	$3\frac{1}{2}$	$4\frac{2}{3}$	$3\frac{2}{3}$	$5\frac{3}{4}$	$6\frac{7}{8}$	$7\frac{9}{10}$	$8\frac{5}{6}$	$7\frac{4}{5}$	$1\frac{1}{2}$
9.	$1\frac{1}{2}$	$2\frac{1}{4}$	$3\frac{1}{5}$	$2\frac{1}{6}$	$7\frac{1}{10}$	$4\frac{1}{3}$	$1\frac{1}{8}$	$5\frac{1}{7}$	$6\frac{1}{9}$	$\frac{1}{2}$
10.	$2\frac{4}{5}$	$3\frac{1}{2}$	$2\frac{5}{6}$	$4\frac{4}{5}$	$3\frac{2}{3}$	$3\frac{1}{4}$	$4\frac{1}{6}$	$4\frac{1}{5}$	$3\frac{3}{4}$	$2\frac{1}{5}$

WAYS OF COMPARING NUMBERS BY RATIOS

There are various ways of comparing numbers.

1. How much more than 10 is 12?

2. How much less than \$15 is \$8?

In both these problems the numbers were compared by subtraction. Numbers may also be compared by division.

3. An apple costs 2¢ and an orange costs 6¢. How many times as much as an apple does an orange cost?

Think: $6 \div 2 = 3$. An orange costs 3 times as much as an apple.

4. If a banana costs 4¢ and a pear costs 8¢, what fraction of the cost of a pear is the cost of a banana?

Think: 4 is what fraction of ? You can see that 4 is $\frac{1}{2}$ of 8.
This is found by dividing 4 by 8. $\frac{4}{8} = \frac{1}{2}$.

When numbers are compared by division, we find their *ratio*. *To find the ratio of two numbers, divide one by the other.*

5. What is the ratio of 10 to 5?

Think: $10 \div 5 = ?$

6. What is the ratio of 2 to 8?

7. A train can travel 40 miles an hour and a man can walk about 4 miles an hour. Compare the speed of the train with that of the man.

Think: What is the ratio of 40 to 4?

What is the ratio of:

8. 4 to 8?	**12.** 9 to 18?	**16.** 15 to 25?	**20.** $\frac{1}{2}$ to $\frac{1}{4}$?
9. 6 to 3?	**13.** 18 to 9?	**17.** 18 to 24?	**21.** $\frac{1}{8}$ to $\frac{5}{8}$?
10. 12 to 4?	**14.** 14 to 6?	**18.** 16 to 12?	**22.** $1\frac{1}{2}$ to $\frac{3}{4}$?
11. 2 to 5?	**15.** 1 to 3?	**19.** 2 to 3?	**23.** $3\frac{1}{3}$ to 10?

24. How many times as much as a $2\frac{1}{2}$-pound chicken does a 5-pound chicken weigh? $5 \div 2\frac{1}{2} = ?$

USING FRACTIONS IN BUYING AND SELLING

Fractions are used very often in buying and selling. If you are rapid and accurate with fractions, you will check very easily the amounts you pay for things that you buy.

1. Harry was a clerk in a grocery store. Mrs. Andrews asked for 25¢ worth of cheese. If cheese was 48¢ a pound, how much should he give her?

$\frac{25}{48} \times 16 = ?$ $\frac{25}{\cancel{48}_{3}}$ of $\cancel{16} = \frac{25}{3} = 8\frac{1}{3}$	Harry thought, "If cheese is 48¢ a pound, 25¢ worth would be $\frac{25}{48}$ of a pound. I shall give her $8\frac{1}{3}$ ounces of cheese."

2. Another customer asked Harry for 30¢ worth of cheese. How many ounces did he give her?

3. Mary wanted 5¢ worth of apples. If apples were 20¢ a dozen, how many did she buy?

4. If oranges are 40¢ a dozen, how many can you buy for 10¢? for 20¢? for 30¢? for 50¢?

5. If bacon is 50¢ a pound, how much can you buy for 75¢?

6. Cookies are 25¢ a dozen. How many can you buy for 10¢? for 15¢?

7. How many inches of ribbon can you buy for 15¢ if the price is 45¢ a yard?

8. At 50¢ a pound, you can buy —— ounces for 25¢.

9. At 40¢ a pound, you can buy —— ounces for 15¢.

10. At 36¢ a pound, you can buy —— ounces for 27¢.

11. At 30¢ a dozen, you can buy —— apples for 10¢.

12. At 45¢ a dozen, you can buy —— oranges for 30¢.

COMPARING SPEEDS

This table shows different methods of travel and the speed for each method in miles an hour.

A man on foot	3 mi.	An ocean liner	30 mi.
A horse	9 mi.	A freight train	15 mi.
An automobile	30 mi.	A racing automobile	207 mi.
A fast passenger train	60 mi.	An airplane	278 mi.

Find the number that should be written in the blank space in each of the following problems:

1. The speed of a horse is —— times that of a man.

2. The speed of a passenger train is —— times that of a horse.

3. A passenger train travels —— times as fast as a freight train.

4. An airplane travels —— times as fast as a passenger train.

5. An ocean liner travels —— times as fast as an automobile.

6. The speed of an ocean liner is —— miles an hour more than a freight train.

7. An airplane travels —— miles an hour faster than a fast passenger train.

8. An ocean liner travels —— miles less in an hour than a racing automobile.

9. An automobile can travel —— times as far as a horse in an hour.

10. 8 is —— times 4.

11. 6 is —— times 4.

12. 5 is —— times 4.

13. 7 is —— times $1\frac{3}{4}$.

14. 3 is —— times 6.

15. 8 is —— times 24.

16. $\frac{1}{2}$ is —— times $\frac{3}{4}$.

17. $2\frac{1}{4}$ is —— times $\frac{1}{9}$.

18. $3\frac{1}{3}$ is —— times 10.

19. 100 is —— times 1,000.

20. What is the ratio of $7\frac{1}{2}$ and $2\frac{1}{2}$?

PRACTICE IN COMPARING NUMBERS

In which of these pairs of numbers is the first number equal to one third of the second?

1. 2, 6	**8.** 4, 2	**15.** 4, 1	**22.** 18, 9
2. 12, 3	**9.** 20, 5	**16.** 8, 4	**23.** 1, 3
3. 8, 40	**10.** 4, 12	**17.** 2, 10	**24.** 16, 4
4. 14, 7	**11.** 32, 8	**18.** 16, 8	**25.** 8, 24
5. 7, 21	**12.** 18, 9	**19.** 2, $\frac{1}{2}$	**26.** 1, 5
6. $\frac{1}{2}$, $\frac{1}{8}$	**13.** $\frac{1}{2}$, $2\frac{1}{2}$	**20.** 9, 27	**27.** $2\frac{1}{2}$, $7\frac{1}{2}$
7. $\frac{1}{2}$, $1\frac{1}{2}$	**14.** $1\frac{1}{2}$, $\frac{3}{4}$	**21.** $3\frac{1}{3}$, 10	**28.** $1\frac{1}{3}$, $\frac{1}{3}$

In which of the above pairs of numbers is the first number equal to 2 times the second?

In which is the first number equal to 4 times the second?

REDUCTIONS AT SALES

1. Helen bought a \$5 tennis racket for \$3.75. What was the reduction? What fraction of the regular price was the reduction?

\$5.00 − \$3.75 = \$1.25. The reduction is \$1.25.

To find what fraction \$1.25 is of \$5.00, divide 125 by 500:

$\frac{125}{500} = \frac{1}{4}$ \$1.25 is $\frac{1}{4}$ of \$5.00.

Copy the following examples, and find the correct figures to replace each question mark.

	Regular Price	Sale Price	Reduction	Fraction of Regular Price
Baseball bat	\$2.00	\$1.50	?	?
Gymnasium slippers	3.00	2.50	?	?
Bicycle tires	4.50	3.50	?	?
Football	5.00	4.50	?	?
Slide	30.00	24.00	?	?
Swing	3.75	2.50	?	?

THE SCHOOL MILK SUPPLY

In the Randall Ward School milk was furnished to the children in the various grades. The pupils ordered the milk for a week in advance. The same quantity was delivered each day. The sixth-grade pupils kept the records.

Grade	Number of Pupils	Milk Ordered Daily
Kindergarten	63	45 half-pint bottles
First grade	32	24 " " "
Second grade	38	19 " " "
Third grade	36	16 " " "
Fourth grade	33	18 " " "
Fifth grade	35	10 " " "
Sixth grade	30	9 " " "

1. How many bottles of milk were ordered daily?

2. How many bottles a week were ordered?

3. At 3¢ for a half-pint bottle, how much did the children in each grade pay a day for the milk?

4. How much was spent in all for the milk each day for the whole school?

5. How many bottles of milk less than there were pupils in the school were ordered daily?

6. The milkman received $2\frac{1}{2}$¢ a bottle for the milk. How much did he receive a day for the milk? how much a week?

7. The sixth-grade class made $\frac{1}{2}$ cent on each bottle sold. What was the profit on the milk sold in a week?

8. The following supplies were purchased: 4 boxes of straws at $22\frac{1}{2}$¢ a box, 10 pounds of soda wafers at $12\frac{1}{2}$¢ a pound. What did these supplies cost?

9. If the same quantity of milk is ordered each week, how long will it take the class to pay for the supplies out of the profits from the sale of the milk?

*10. The city nurse believes that 3 of the children need the milk, but cannot afford it. What will a week's supply for these children cost?

*11. The secretary of the Woman's Club asked the following questions regarding the supplying of milk in the Randall School:

a. What fraction of the pupils in each grade are ordering milk?

b. How many gallons are being supplied weekly?

c. How many more gallons would be required if milk were purchased for all the pupils?

d. What would be the additional cost?

e. What would be the total cost of supplying all the pupils with milk for the school year of 38 weeks?

*12. If each pupil in your school were to have a half pint of milk a day, how many bottles would be needed?

*13. How many gallons of milk would be needed?

*14. What would the milk cost at local prices?

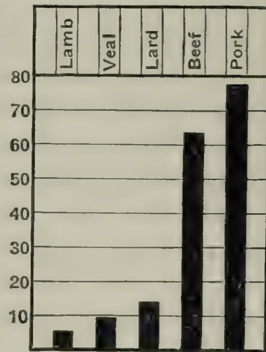
*15. Why is it important for children to drink milk each day?

A MIXED DRILL

Give the answers orally. Do not use a pencil. Practice until the work is easy.

1. $27 + 48 =$	**16.** $\frac{4}{5} \div \frac{2}{3} =$	**31.** $3\frac{1}{3} + 4\frac{5}{6} =$
2. $93 - 67 =$	**17.** $\$.06 + \$.03 =$	**32.** $3\frac{4}{5} - \frac{9}{10} =$
3. $9 \times 86 =$	**18.** $47 + 36 =$	**33.** $3\frac{3}{4} \times \frac{1}{5} =$
4. $256 \div 32 =$	**19.** $95 - 38 =$	**34.** $\$5 \div 10 =$
5. $\frac{1}{3} + \frac{1}{6} =$	**20.** $7 \times 58 =$	**35.** $37 + 59 =$
6. $5 - \frac{1}{4} =$	**21.** $540 \div 60 =$	**36.** $86 - 49 =$
7. $\frac{9}{10} \times \frac{5}{6} =$	**22.** $2\frac{1}{2} + \frac{1}{6} =$	**37.** $7 \times 96 =$
8. $5 \div \frac{1}{4} =$	**23.** $2\frac{1}{4} - \frac{1}{5} =$	**38.** $312 \div 78 =$
9. $65 + 29 =$	**24.** $2\frac{1}{3} \times 3 =$	**39.** $7\frac{1}{2} + \frac{1}{4} + \frac{3}{8} =$
10. $74 - 29 =$	**25.** $3\frac{1}{2} \div 7 =$	**40.** $4\frac{5}{8} - 3\frac{11}{16} =$
11. $8 \times 79 =$	**26.** $\$.06 \times 8 =$	**41.** $20 \times 3\frac{1}{3} =$
12. $343 \div 49 =$	**27.** $25 + 68 =$	**42.** $\$.35 - \$.07 =$
13. $\frac{3}{4} + \frac{3}{4} =$	**28.** $52 - 37 =$	**43.** $3\frac{1}{5} \div \frac{4}{5} =$
14. $9 - \frac{2}{3} =$	**29.** $9 \times 79 =$	**44.** $8 \times 85 =$
15. $8 \times \frac{4}{4} =$	**30.** $486 \div 54 =$	**45.** $79 + 14 =$

OUR ANNUAL MEAT CONSUMPTION



The graph at the right shows the amounts of the different kinds of meat and lard consumed a year, on the average, by each person in the United States.

1. Find the amount of pork consumed a person a year.

You cannot tell exactly the number of pounds but you can see that about 78 pounds of pork were consumed.

2. Estimate the number of pounds of beef consumed a year in the same way that you estimated the number of pounds of pork.

3. Estimate the amount of veal consumed a year by each person; the amount of lamb; the amount of lard.

4. Find the total amount of meat consumed a year on the average.

5. Estimate the number of pounds of meat and lard consumed a person a year.

6. If a family of five adults ate the average amount of each kind of meat, how many pounds of each kind did this family eat in a year?

7. Find the total amount of meat eaten by this family in a year.

8. How many pounds less of beef than of pork were eaten, on the average, by each person?

9. How many pounds of beef and veal were used?

10. How many pounds of pork and lard were used?

11. The beef used is how many times the amount of veal used?

12. The amount of beef used is how many times the weight of the mutton used?

13. What is the ratio of the number of pounds of lamb used to the number of pounds of veal?

14. How many times as much pork as veal is used?

15. Choice porterhouse steak sells in some of our cities at 65¢ a pound. Chuck roasts may be bought for about 28¢ a pound. What would be the cost of the beef used annually by a man who used only porterhouse? How much less would he spend if he used only chuck roasts?

16. Englishmen eat only $\frac{5}{8}$ as much meat as we do. How many pounds of meat are consumed, on the average, each year by an Englishman?

PRACTICE TESTS IN FUNDAMENTALS

Addition Test (4 examples in 5 minutes, including checking but not copying)

1.	2.	3.	4.	5.	6.
927	747	788	869	123	113
855	902	484	926	861	795
562	627	868	742	289	571
689	956	433	488	575	574
375	847	973	647	241	313
869	945	809	583	395	644
348	698	587	376	319	625

Subtraction Test (5 examples in 2 minutes, including checking but not copying)

1.	2.	3.	4.	5.	6.
94,170	81,004	90,135	74,628	96,115	87,928
27,365	26,378	26,497	55,879	37,569	87,856

Multiplication Test (6 examples in 3 minutes, including checking but not copying)

1.	3.	5.	7.	9.	11.
428	529	719	246	913	356
57	63	94	28	75	49

2.	4.	6.	8.	10.	12.
163	657	817	824	935	847
63	75	82	49	28	36

Division Test (6 examples in 8 minutes, including checking but not copying).

1. $36\overline{)47{,}621}$	3. $73\overline{)28{,}436}$	5. $64\overline{)20{,}544}$	7. $81\overline{)56{,}943}$
2. $35\overline{)10{,}998}$	4. $58\overline{)10{,}672}$	6. $38\overline{)14{,}668}$	8. $44\overline{)13{,}508}$

DIAGNOSTIC TEST NO. I

This exercise will test your ability to work different kinds of examples. If you have difficulty with any of the examples, practice on others like them.

1. $\frac{1}{2} + \frac{1}{3} + \frac{1}{4} =$
2. $25\frac{3}{4} - 16\frac{7}{8} =$
3. $7\frac{3}{4} \times 28 =$
4. $3\frac{1}{3} \div \frac{2}{3} =$
5. Divide 290,639 by 571.
6. Find the product of 408 and 709.
7. Find $\frac{3}{4}$ of 42.
8. Change 3 yards 6 inches to inches.
9. Find the number of gallons in 48 pints.
10. $60 = ? \times 4$.
11. Find the average of 47, 36, and 91.
12. $100 \times 48 =$; $10 \times 46 =$
13. What is the ratio of 50 to 100?
14. Compare $\frac{7}{8}$ and $\frac{3}{4}$ by division.
15. 16 is what fraction of 32?
16. 48 is what part of 60?
17. Find the sum of 684, 336, 956, 742, 493, and 536.
18. Subtract 25,896 from 98,921.
19. Multiply 747 by $23\frac{7}{9}$.
20. Divide 481,216 by 5,856.

PROBLEM SCALE I

1. One morning Harry dug $8\frac{1}{2}$ bushels of potatoes. He sold $4\frac{1}{4}$ bushels to a neighbor. In the afternoon he dug $3\frac{1}{4}$ bushels more. How many bushels did he then have?

2. A man living in a village kept two cows. One gave

$6\frac{1}{2}$ pounds of butterfat a week; the other gave $1\frac{1}{2}$ pounds more. How many pounds did they both produce in a week?

3. A lady bought $4\frac{1}{3}$ yards of calico at 15¢ a yard for a dress and other material costing $.75. Find the total cost.

4. Harry raised $25\frac{1}{4}$ bushels of potatoes on a part of his father's garden. He gave his father $6\frac{1}{2}$ bushels for the rent of the land and sold the rest for $1.00 a bushel. How much did he receive for them?

5. Harry worked at the drug store $1\frac{3}{4}$ hours on Wednesday and $2\frac{1}{2}$ hours on Saturday. He was paid $.40 an hour. How much did he earn for his work on the two days?

6. Mary wished to make 4 pennants. If she needed $\frac{3}{8}$ yard of ribbon for each pennant, what would the ribbon cost at $.20 a yard?

7. Mr. Jones had 100 pounds of chicken feed in a bag. He filled a 10-pound can and a small pail with the feed. He then found that he had $75\frac{1}{2}$ pounds of chicken feed left in the bag. What did the feed in the pail weigh?

8. Some boy scouts planned to take a $6\frac{1}{4}$-mile hike before school one morning. If they left at 6 o'clock and walked at the rate of $2\frac{1}{2}$ miles an hour, at what time would they return?

9. Five men went on a camping trip. They estimated that they should have $1\frac{1}{2}$ pounds of flour a day for each man. If they took 150 pounds of flour with them, how long would it last at this rate?

10. Mr. Smith used $7\frac{1}{2}$ bushels of seed corn to plant a 10-acre field. Find the cost of seed corn an acre at $2.20 a bushel.

Standards

Excellent	9 or 10 correct
Good	7 or 8 correct
Fair	5 or 6 correct
Unsatisfactory	0 to 4 correct

CHAPTER II

A RAILROAD TIME-TABLE

Below is a section of a railroad time-table.

TABLE 8 CLINTON—ANAMOSA

143	141	Mi.	STATIONS			142	144
AM	PM					PM	PM
8.00	4.35	0.	Lv	**CLINTON**	Ar	12.05	2.30
8.20	4.45	2.6	Ar	Lyons	Lv	11.54	2.15
8.45	5.02	10.4	"	Almont	"	11.37	2.00
8.55	5.09	12.8	"	Andover	"	11.30	1.50
9.15	5.20	17.2	"	Bryant	"	11.20	1.40
9.30	5.27	19.8	"	Goose Lake	"	11.10	1.20
9.50	5.38	24.6	"	Charlotte	"	10.59	1.05
10.10	5 47	28.7	"	Petersville	"	10.49	12.40
10.40	5.57	32.7	"	Delmar	"	10.40	12.25
11.10	6.10	38.1	"	Maquoketa	"	10.25	12.05
11.30	6.25	44.3	"	Nashville	"	10.09	11.30
11.40	6 30	47.0	"	Baldwin	"	10.02	11.20
11 55	6 40	49.6	"	Monmouth	"	9 55	11.10
12 20	6.59	56.8	"	Onslow	"	9.37	10.45
12.35	7.09	60.8	"	Center Junction	"	9 27	10.20
12.50	7.20	65.8	"	Amber	"	9.15	10.05
1.15	7.35	71 4	Ar	**ANAMOSA**	Lv	9 00	9 45

1. At what time does Train No. 141 leave Clinton?

2. How far is it from Clinton to Anamosa?

3. How long does it take to travel from Clinton to Anamosa?

4. Copy the following table and fill in the missing information:

	DISTANCE	TIME
Clinton to Goose Lake...........		
Goose Lake to Amber.............		
Andover to Center Junction.......		
Lyons to Monmouth..............		
Nashville to Anamosa............		

ADDITION AND SUBTRACTION OF DECIMALS

1. The newspaper reported that on Monday 1.7 inches of rain fell, on Tuesday 2.25 inches, and on Wednesday 1.875 inches. How much rain fell during the three days?

1.7 **2.25** **1.875** **5.825**	1.7 in. + 2.25 in. + 1.875 in. = ? Write these numbers so that the decimal points are in a straight line one under the other. Add as with whole numbers. Place the decimal point in the sum under the decimal points in the numbers being added.

2. How many inches of rain fell on Monday and Tuesday? on Tuesday and Wednesday?

3. How much more rain than **on** Monday fell on Wednesday?

1.875 in. **−1.7 in.** **.175 in.**	1.875 in. − 1.7 in. = ? Write the numbers so that the decimal points are in a line one under the other. Place the decimal point in the answer directly under the decimal points in the numbers subtracted.

4. How much less rain than on Tuesday fell on Wednesday?

2.250 in. **1.875 in.** **.375 in.**	2.25 in. − 1.875 in. Write a 0 in the minuend so that the minuend will have the same number of decimal places as the subtrahend.

Find the sum of each of the following examples:

5.	**6.**	**7.**	**8.**
3.257	5.92	85.4	85.
4.267	68.75	7.63	7.275
8.15	74.156	194.85	1.04

Subtract the following:

9. 9.46 ft.	**10.** 8.714 mi.	**11.** 17.48 lb.	**12.** 147.5
7.14 ft.	5.26 mi.	9.564 lb.	5.267

13. An airplane flew 95.7 miles one day, 76.24 miles the second day, and 796.89 miles the third day. How many miles did the airplane fly in three days?

14. The total weight of a wagon loaded with coal was 4.8 tons. The wagon alone weighed .375 ton. Find the weight of the coal.

15. At a field meet a runner ran 100 yards in 9.65 seconds. The record for the track was 10.1 seconds. How much less time than the record did the runner take?

Copy the numbers in each example and find the sums. Be sure to place the decimal points one under the other.

16. .85, .81, .46, 74
17. .3, .75, .46, .014, .5
18. .58, .475, .6, .84, .7
19. 3.8, 1.75, 5.9, 6.741
20. 97.5, 884.6, 9.75, .5
21. 64.66, 78.9, 5.974, 6.4
22. 347.1, 58.6, 7.94, 1.8
23. 5.6, .6, 7.85, 100.4

Subtract the following:

24. 6.48 − 4.51 =
25. 5.9 − 4.72 =
26. 12.175 − 2.11 =
27. 18.547 − 7.368 =
28. 5.7 − 1.743 =
29. 200.3 − 5.64 =
30. 8 − 5.62 =
31. 77.8 − .85 =
32. 49.7 − 48.75 =
33. 33.50 − .675 =

34. Helen rode 22.5 miles on her new bicycle on Monday, 17.1 miles on Tuesday, and only .9 mile on Wednesday. How many miles did she ride on these three days?

35. Jack's father drove 231.6 miles in his automobile on Monday and 75.9 miles on Tuesday. How much farther than on Tuesday did he drive on Monday?

TWO WAYS OF READING DECIMALS

1. Read this mixed decimal: 43.764. This number may be read *43 and 764 thousandths.* Business people have found that an easier and more accurate way of reading such a number is as follows: *Four three point seven six four.* The word *point* shows where the decimal point is.

Read these decimals in two ways. Which do you think is the easier way? Then write them from dictation. Your teacher will dictate them in the two ways. Was one way easier and more accurate than the other?

	a	*b*	*c*	*d*	*e*
2.	9.75	3.005	63.15	.003	100.1
3.	86.2	68.02	9.875	1.043	101.1
4.	95.047	75.109	160.01	120.006	1.001

USING THE DECIMAL POINT

In the following sentences there are numbers with the decimal points missing. Place the decimal point so that the statements are reasonable.

1. A boy was 575 inches tall.

2. He weighed 9725 pounds.

3. He gained 75 pounds in weight in one year.

4. A train traveled 365 miles an hour.

5. The world's record for the hundred-yard dash is 96 seconds.

6. The cost of a school reader is $125.

7. 45 inches of rain fell in one day.

8. Mrs. Jones bought a roast weighing 375 pounds.

9. An ocean liner has a record of 325 miles an hour.

10. A dozen eggs weigh 175 pounds.

11. A quart of milk weighs about 213 pounds.

12. Three inches is 25 yard.

LONGER DECIMALS

Sometimes numbers are used in which there are more than three decimal places. For example, some of the parts for automobiles are accurate to one ten thousandth of an inch (.0001 in.). A difference of .00015 inch is read 15 hundred-thousandths of an inch. .17684 is read 17 thousand 684 hundred-thousandths.

Hundred Thousands	Ten thousands	Thousands	Hundreds	Tens	Units	Tenths	Hundredths	Thousandths	Ten-thousandths	Hundred-thousandths	Millionths
6	0	8,	7	4	1.	5	9	6	2	3	2

Read the name of each digit of the number above, 608,741.596232. How do the names of the digits to the right of the units differ from those to the left?

In most of the work which you will do with decimals, you will not use more than three decimal places; but so that you may know how to read decimal numbers of 4 or 5 places, practice reading the following numbers:

1. .1572	**3.** .13684	**5.** 3.5764	**7.** 5.17004
2. .0465	**4.** .57963	**6.** 4.0001	**8.** 27.00475

Write as numbers:

9. One hundred twenty ten-thousandths.

10. Six thousand eight hundred-thousandths.

11. Three and nine ten-thousandths.

12. Fifty-six and eighty-five ten-thousandths.

MULTIPLYING DECIMALS BY 10, 100, 1,000

1. At $.05 each, what is the cost of 10 apples? 100 apples? 1,000 apples?

10 × $.05 = $.50 **100 × .05 = 5.00** **1,000 × .05 = 50.00**	Notice how the decimal point is shifted when $.05 is multiplied by 10, 100, 1,000.

To multiply a decimal by 10, shift the decimal point one place to the right; to multiply by 100, shift the decimal point two places to the right; and to multiply by 1,000, shift the decimal point three places to the right.

Give the products:

2. 10 × .15 =	**6.** 100 × .15 =	**10.** 1,000 × .15 =
3. 10 × .04 =	**7.** 100 × .04 =	**11.** 1,000 × .04 =
4. 10 × 1.5 =	**8.** 100 × 1.5 =	**12.** 1,000 × 1.5 =
5. 10 × 1.06 =	**9.** 100 × 1.06 =	**13.** 1,000 × 1.06 =

MULTIPLYING A DECIMAL AND A WHOLE NUMBER

A certain automobile made a mile in 26.45 seconds. How long would it take the automobile to go 5 miles?

26.45 **5** **132.25**	When multiplying a decimal by a whole number, multiply as with whole numbers. Point off as many places in the product as there are decimal places in the numbers being multiplied.

Find these products:

1. 3 × 2.75 =	**3.** 4 × .035 =	**5.** 24 × 37.5 =
2. 12 × 36.25 =	**4.** 83 × 2.684 =	**6.** 93 × 8.002 =

7. How far can an ocean liner go in 6 hours at the rate of 22.65 knots an hour?

MULTIPLYING A DECIMAL BY A DECIMAL

1. What is the product of .3 and .3?

> Change .3 to $\frac{3}{10}$. $\frac{3}{10} \times \frac{3}{10} = \frac{9}{100} = .09$
> $.3 \times .3 = .09$

2. What is the product of .3 and .07?

> Change .3 to $\frac{3}{10}$ and .07 to $\frac{7}{100}$
> $.3 \times .07 = \frac{3}{10} \times \frac{7}{100} = \frac{21}{1000} = .021$

3. For each of these two examples answer the following questions:

a. How many decimal places are in the multiplier?
b. How many decimal places are in the multiplicand?
c. How many decimal places are in the product?
d. How does the number of decimal places in the product compare with the number in the multiplier and in the multiplicand together?

The following rule will help you when you are multiplying two numbers containing decimals:

After multiplying one decimal by another, point off as many decimal places in the product as there are decimal places in the numbers being multiplied. Count from the right.

Apply this rule to the examples below:

a	*b*	*c*	*d*
4.7 ft.	\$4.18	.165	275
.5	3	.3	1.7
2.35 ft.	\$12.54	.0495	1925
			275
			467.5

PRACTICE IN PLACING DECIMAL POINTS IN MULTIPLICATION

The following examples are finished, except for the placing of the decimal points in the products. Copy each example and insert the decimal point in the product.

1. $\begin{array}{r}4.1\\ .3\\ \hline 123\end{array}$	**5.** $\begin{array}{r}5.2\\ 4\\ \hline 208\end{array}$	**9.** $\begin{array}{r}.26\\ 4\\ \hline 104\end{array}$	**13.** $\begin{array}{r}.47\\ .5\\ \hline 235\end{array}$
2. $\begin{array}{r}25\\ .7\\ \hline 175\end{array}$	**6.** $\begin{array}{r}2.64\\ .3\\ \hline 792\end{array}$	**10.** $\begin{array}{r}58.4\\ .05\\ \hline 2920\end{array}$	**14.** $\begin{array}{r}26.04\\ .9\\ \hline 23436\end{array}$
3. $\begin{array}{r}25.7\\ .12\\ \hline 3084\end{array}$	**7.** $\begin{array}{r}.25\\ .3\\ \hline 75\end{array}$	**11.** $\begin{array}{r}.573\\ .4\\ \hline 2292\end{array}$	**15.** $\begin{array}{r}6.25\\ .94\\ \hline 58750\end{array}$
4. $\begin{array}{r}8.74\\ .08\\ \hline 6992\end{array}$	**8.** $\begin{array}{r}6.57\\ 1.5\\ \hline 9855\end{array}$	**12.** $\begin{array}{r}25.6\\ .74\\ \hline 18944\end{array}$	**16.** $\begin{array}{r}.21\\ .4\\ \hline 84\end{array}$

MULTIPLYING WITH DECIMALS

1. At the rate of 32.5 miles an hour, how far will a passenger train travel in 7.5 hours?

Find the products.

2. $\begin{array}{r}.01\\ 0.2\\ \hline\end{array}$	**5.** $\begin{array}{r}.64\\ 0.1\\ \hline\end{array}$	**8.** $\begin{array}{r}.874\\ 2\\ \hline\end{array}$	**11.** $\begin{array}{r}.985\\ 3\\ \hline\end{array}$	**14.** $\begin{array}{r}6.47\\ 3\\ \hline\end{array}$
3. $\begin{array}{r}715\\ .008\\ \hline\end{array}$	**6.** $\begin{array}{r}847\\ .032\\ \hline\end{array}$	**9.** $\begin{array}{r}5.73\\ 6.1\\ \hline\end{array}$	**12.** $\begin{array}{r}85.2\\ .97\\ \hline\end{array}$	**15.** $\begin{array}{r}384\\ 0.08\\ \hline\end{array}$
4. $\begin{array}{r}37.5\\ .42\\ \hline\end{array}$	**7.** $\begin{array}{r}5.01\\ .16\\ \hline\end{array}$	**10.** $\begin{array}{r}3.04\\ 1.5\\ \hline\end{array}$	**13.** $\begin{array}{r}52.1\\ .04\\ \hline\end{array}$	**16.** $\begin{array}{r}35.6\\ .07\\ \hline\end{array}$

17. Find the cost of 3.4 gallons of gasoline at 25¢ a gallon.

FINDING RAILROAD FARES

Railroad officials use decimals in determining the fare between stations. If the rate is 3.6¢ a mile, and the distance between two stations, such as Omaha and Sioux City, is 98.5 miles, they say the fare is 99 × 3.6¢, or $3.56.

$.036 × 99 = ? **.036** **99** **324** **3 24** **3.564**	3.6¢ can be written as $.036. How many decimal places are in the multiplier and the multiplicand? How many decimal places must there be in the product? The product is $3.564. Usually the decimal part of a cent is dropped if it is less than 5 tenths. The fare would, therefore, be $3.56.

1. Find the fare from Omaha to Missouri Valley, a distance of 24.2 miles, at 3.6¢ a mile.

2. Turn to the railroad time-table from Clinton to Anamosa on page 263. Find the fare from Clinton to each of the first five stations in the table.

3. 3.5 × 4.5¢ = ?

4. 4.8 × 7.5¢ = ?

5. 84.6 × 12.5¢ = ?

6. 48.6 × 25.7¢ = ?

7. 17.25 × 3.6¢ = ?

8. 14.8 × $.375 = ?

RAISING SUGAR CANE IN LOUISIANA

1. A good sugar-cane field will yield 17.5 tons of sugar cane an acre. How many pounds is this an acre?

2. In one year the average yield of sugar cane an acre was 10.4 tons. In another year the average yield was only 7.9 tons an acre. What was the difference between the average yields in these two years?

3. In good cane the sugar yield is $\frac{1}{10}$ the weight of the cane. How many pounds of sugar would a ton of sugar cane yield at this rate?

4. In one year a ton of cane yielded 148 pounds. How much less a ton than the yield found in problem **3** was this?

5. In a recent year the yield of cane averaged 7.9 tons an acre. At 7.2¢ a pound for raw sugar, what was the value of sugar an acre?

6. If 60 pounds of sugar cane yielded 36 pounds of juice and the juice yielded 6 pounds of sugar, what fraction of the cane was sugar? What fraction of the juice was sugar?

7. Our people eat, on the average, 148 pounds of sugar a person. An acre in Louisiana planted to sugar cane produced 14.8 tons of cane which yielded 140 pounds of sugar a ton. How many persons will this field supply for a year?

8. A 10-acre sugar-cane field yielded 1,598 pounds of raw sugar. What was the average yield of raw sugar an acre? What was the value of the yield an acre at 3.6 cents a pound?

DIVIDING A DECIMAL BY A WHOLE NUMBER

1. Two chairs cost \$17.50. Find the cost of one chair.

$$2\overline{)\$17.50}\quad \$8.75$$

If you study this example you will note that the decimal point in the quotient was placed directly over the decimal point in the dividend.

When dividing a decimal by a whole number, place the decimal point in the quotient directly over the decimal point in the dividend. Use zeros to fill empty places in the quotient.

Study these examples to see how the rule applies:

1.22	6.5	.332	.09	.024
8)9.76	7)45.5	4)1.328	5).45	2).048

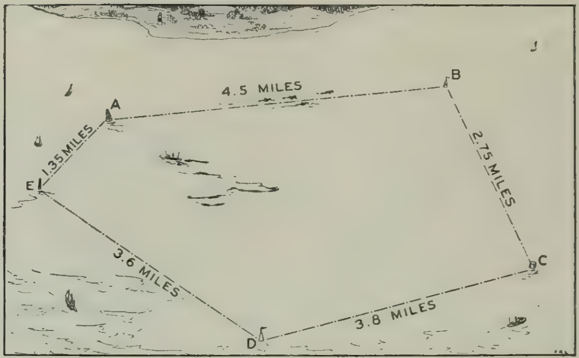
In the last two examples 0 was needed to fill the vacant place between the decimal point and the first figure in the quotient.

Find the quotients.

	a	*b*	*c*	*d*	*e*
2.	5)6.75	8)44.8	6)5.706	4).36	3).096
3.	7)85.4	7)9.24	4).48	8)2.808	2)15.84
4.	4)3.264	8).064	3)7.29	2).014	7)4.2
5.	9).45	7).49	6)1.578	6)19.476	3)8.7
6.	6).126	4)1.736	5).0735	3).75	5)8.755

7. A horse traveled 12.69 miles in 3 hours. How many miles did he average an hour?

8. During a three-hour rain storm 4.74 inches of rain fell. How much an hour was that on the average?



MOTOR-BOAT RACES

Each summer there were motor-boat races at Lake Calhoun. This is a map of the course, showing the distances between various points on the course.

1. How far is it from A to B?

2. Find the distance from A to C, by way of B.

3. In the same way find the distance from A to D; from A to E.

4. Find the entire length of the course.

5. A motor boat had reached C. Was it then halfway around the course? how much more or less?

6. When the boat had reached E, how much more than $\frac{3}{4}$ of the way was it?

7. Harry made the distance around the course in 30 minutes. What was his speed a minute?

8. Jack made the distance in 28 minutes 38 seconds. How much less time than Harry did Jack take?

9. George Brown went around the course 5 times in one afternoon. How many miles was this in all?

EFFECT OF MULTIPLYING NUMBERS BY 10, 100, AND 1,000

1. Compare the quotients in the following examples:

$$\begin{array}{r}24\\16\overline{)384}\end{array}\qquad\begin{array}{r}24\\160\overline{)3{,}840}\end{array}\qquad\begin{array}{r}24\\1{,}600\overline{)38{,}400}\end{array}$$

2. How does the second example differ from the first?

3. What was done to both the divisor and the dividend of the first example to make the third example? Did this effect the value of the quotient?

From this work it is clear that both the divisor and dividend of an example may be multiplied by the same number without changing the value of the quotient.

Prove this rule in the following examples:

4. $25\overline{)625}$ **6.** $250\overline{)6{,}250}$ **8.** $2{,}500\overline{)62{,}500}$

5. $11\overline{)352}$ **7.** $110\overline{)3{,}520}$ **9.** $1{,}100\overline{)35{,}200}$

10. $\frac{.8}{.4} = \frac{8.0}{4.0} = \frac{8}{4}$. Why?

11. $.9 \div .3 = \frac{.9}{.3} = \frac{9.0}{3.0} = \frac{9}{3}$. Why?

An example like $8.6\overline{)78.4}$ can be changed to $86\overline{)784}$ by multiplying both divisor and dividend by 10. $\frac{78.4}{8.6} = \frac{784.0}{86.0} = \frac{784}{86}$. Instead of having a decimal for the divisor, there is a whole number. $8.6\overline{)78.4} = 86\overline{)784} = ?$

Change the divisor of each example to a whole number by multiplying in each example by 10, by 100, or by 1,000, as may be necessary. Be sure to multiply the dividend by the same number. Then find each quotient.

12. $.5\overline{).55}$ **14.** $.75\overline{).15}$ **16.** $.64\overline{)13.2}$ **18.** $8.5\overline{)59.5}$

13. $1.1\overline{).55}$ **15.** $.25\overline{)1.25}$ **17.** $7.3\overline{)3.65}$ **19.** $4.2\overline{)168}$

DIVIDING BY DECIMALS

1. Divide 17.03 by 1.3.

$1.3\overline{)17.03}$	Change the divisor 1.3 to a whole number by shifting the decimal point one place to the right.
$13.\overline{)170.3}$	The decimal point in 17.03 must also be shifted one place to the right.

Study the following examples:

A. $.13\overline{)17.03}$ $13.\overline{)1703.}$	How many places was the decimal point in A shifted to the right?
B. $.13\overline{)170.3}$ $13.\overline{)17030.}$	The decimal point in B is shifted two places in the divisor. Since there is only one decimal place in the dividend, one zero is put in so that the decimal point can be shifted two places.
C. $.25\overline{)75.}$ $25.\overline{)7500.}$	Since the decimal point is shifted two places in the divisor, two zeros are needed to fill in the places to the new decimal point in the dividend.

This work shows that the steps in dividing by decimals are:

a. *Move the decimal point in the divisor as many places to the right as are necessary to change the divisor to a whole number.*

b. *Move the decimal point in the dividend the same number of places to the right. Annex zeros to fill in the empty spaces.*

c. *Place the decimal point in the quotient directly over the new decimal point in the dividend and divide as with whole numbers.*

2. Find the quotients in A, B, and C.

3. $62.5 \div 2.5 = ?$
4. $7.65 \div 1.5 = ?$
5. $1.44 \div .12 = ?$
6. $2.75 \div .5 = ?$
7. $1.771 \div 1.1 = ?$
8. $.169 \div 1.3 = ?$
9. $296 \div .4 = ?$
10. $37.5 \div .25 = ?$
11. $36.8 \div .08 = ?$
12. $24 \div .12 = ?$
13. $6.5 \div .13 = ?$
14. $48 \div .24 = ?$

MORE DIFFICULT DIVISION OF DECIMALS

1. If a fast mail train travels a mile in 1.25 minutes, how many miles does it travel in 31.25 minutes?

25. **1.25$_\wedge$)31.25$_\wedge$** **25 0** **6 25** **6 25**	In working long division examples with decimals, do not re-write the examples. Instead, use a $\wedge$ to show how the decimal points have been shifted. The decimal point in the quotient is placed directly above the $\wedge$ in the dividend. Place the decimal point in the quotient before you divide.

2. At the rate of 48.7 miles an hour, how long does it take a passenger train to travel 4 miles?

.082+ **48.7$_\wedge$)4.0$_\wedge$000** **3 8 96** **1 040** **974** **66**	Here it is necessary to annex zeros, for there is a remainder in each division. After the work has been carried to three places, there is a remainder of 66. Since 66 is less than $\frac{1}{2}$ of 487, we write the quotient as .082 +. If the remainder had been more than $\frac{1}{2}$ of 487, we would write the quotient as .083 −.

Find the quotients. Check your work.

3. $6.2\overline{)19.84}$	**9.** $7.2\overline{)1.512}$	**15.** $.026\overline{)8.508}$	**21.** $39\overline{)4.0}$
4. $5.7\overline{)347.7}$	**10.** $54\overline{)491.4}$	**16.** $.097\overline{)40.74}$	**22.** $5.1\overline{)1.0}$
5. $.64\overline{)5.796}$	**11.** $74\overline{)62.16}$	**17.** $1.14\overline{)25.422}$	**23.** $84\overline{).79}$
6. $6.7\overline{)415.4}$	**12.** $2.6\overline{)18.278}$	**18.** $.21\overline{)196.812}$	**24.** $7.6\overline{)1.9}$
7. $.93\overline{)30.69}$	**13.** $.56\overline{)2.2792}$	**19.** $55\overline{)39.05}$	**25.** $9\overline{).17}$
8. $2.15\overline{)918.05}$	**14.** $.726\overline{)392.04}$	**20.** $37.5\overline{)753.75}$	**26.** $33\overline{)1.5}$

PLACING DECIMAL POINTS IN QUOTIENTS

1. In these examples are the decimal points in the quotients correctly placed?

$\begin{array}{r}2.7\\ .25\overline{).675}\end{array}$	$\begin{array}{r}.09\\ 4\overline{).36}\end{array}$	$\begin{array}{r}.11\\ 3.2\overline{).352}\end{array}$	$\begin{array}{r}360.\\ .184\overline{)66.240}\end{array}$	$\begin{array}{r}56.\\ .25\overline{)14.00}\end{array}$

In the following examples the numbers in the quotients are correct. Where should the decimal points be placed? Be ready to read the answers.

2. $\begin{array}{r}81\\ .08\overline{)6.48}\end{array}$	**9.** $\begin{array}{r}11\\ 1.5\overline{)165}\end{array}$	**16.** $\begin{array}{r}36\\ .84\overline{)3.024}\end{array}$	**23.** $\begin{array}{r}160\\ .214\overline{)34.24}\end{array}$
3. $\begin{array}{r}98\\ .9\overline{)8.82}\end{array}$	**10.** $\begin{array}{r}15\\ 1.1\overline{)16.5}\end{array}$	**17.** $\begin{array}{r}13\\ .13\overline{)16.9}\end{array}$	**24.** $\begin{array}{r}1231\\ 0.6\overline{)738.6}\end{array}$
4. $\begin{array}{r}138\\ .7\overline{).966}\end{array}$	**11.** $\begin{array}{r}12\\ .12\overline{)1.44}\end{array}$	**18.** $\begin{array}{r}630\\ .012\overline{)7.56}\end{array}$	**25.** $\begin{array}{r}90\\ .5\overline{)45.}\end{array}$
5. $\begin{array}{r}25\\ .25\overline{).625}\end{array}$	**12.** $\begin{array}{r}23\\ .21\overline{)4.83}\end{array}$	**19.** $\begin{array}{r}21\\ 4.5\overline{)94.5}\end{array}$	**26.** $\begin{array}{r}48\\ 1.57\overline{)7.536}\end{array}$
6. $\begin{array}{r}36\\ 8.4\overline{)3.024}\end{array}$	**13.** $\begin{array}{r}20\\ .11\overline{)2.2}\end{array}$	**20.** $\begin{array}{r}32\\ 2.1\overline{)6.72}\end{array}$	**27.** $\begin{array}{r}19890\\ .004\overline{)79.56}\end{array}$
7. $\begin{array}{r}121\\ 8\overline{)9.68}\end{array}$	**14.** $\begin{array}{r}12\\ 12\overline{)144}\end{array}$	**21.** $\begin{array}{r}43\\ .121\overline{)5.203}\end{array}$	**28.** $\begin{array}{r}14\\ 30.1\overline{)42.14}\end{array}$
8. $\begin{array}{r}91\\ 4\overline{)3.64}\end{array}$	**15.** $\begin{array}{r}18\\ 1.1\overline{)19.8}\end{array}$	**22.** $\begin{array}{r}12\\ 2.04\overline{)24.48}\end{array}$	**29.** $\begin{array}{r}170\\ 4.05\overline{)688.5}\end{array}$

Find the quotients:

30. $2.5\overline{)6.25}$	**34.** $3.01\overline{)42.14}$	**38.** $2.1\overline{)483}$
31. $.11\overline{)16.5}$	**35.** $21.4\overline{)342.4}$	**39.** $.12\overline{)75.6}$
32. $1.21\overline{)5.203}$	**36.** $.084\overline{)30.24}$	**40.** $45\overline{)9.45}$
33. $.157\overline{)75.36}$	**37.** $.25\overline{).165}$	**41.** $121\overline{)5.203}$

PROBLEMS ABOUT COAL

1. A cubic foot of water weighs 62.5 pounds. A cubic foot of bituminous coal weighs 1.3 times as much. Find the weight of a cubic foot of this coal.

2. A cubic-foot lump of Pennsylvania anthracite weighs 91.875 pounds. How many times as heavy as water is this?

3. Find the difference in weight between a cubic foot of bituminous coal and a cubic foot of anthracite.

4. In a recent year the anthracite miners dug, on the average, 2.1 tons of coal in a working day of 7.35 hours. How many hours did it take to dig one ton?

5. A miner was paid, on the average, \$7.35 a day. How much was he paid an hour? \$7.35 ÷ 7.35 = ?

6. How much did the coal company pay the miner for digging one ton of coal? \$7.35 ÷ 2.1 = ?

7. At the mine, anthracite was sold for \$5.67 a ton. How much more than it paid the miner did the coal company charge for the coal?

8. The freight rate from Scranton, Pennsylvania, to Chicago, Illinois, was \$5.67 a ton. Add this amount to the cost of the coal at the mine and find what the coal cost a dealer a ton delivered in Chicago.

9. The coal dealer in Chicago added, on the average, \$2.15 a ton to the price for handling it. What did the customers pay for a ton?

10. Find the cost of $7\frac{1}{2}$ tons of coal delivered to a customer in Chicago.

11. Mr. Jacks used 6.3 tons of anthracite one winter. At the rate found in problem **4**, how many hours would it take the miner to dig this amount of coal?

DIVIDING BY 10, 100, AND 1,000

1. Harry's father sold 100 bushels of apples for $200. How much did he receive a bushel? $200 ÷ 100 = $2.00.

2. He sold 10 bushels of pears for $25. How much did he receive a bushel? $25.00 ÷ 10 = $2.50.

When dividing a number by 10, *move the decimal point one place to the left.*

When dividing a number by 100, *move the decimal point two places to the left. Prefix zeros when necessary.* $6.00 ÷ 100 = $.06.

When dividing a number by 1,000 *move the decimal point three places to the left. Prefix zeros when necessary.* $6.00 ÷ 1,000 = $.006.

State the quotients:

3. 45 ÷ 10 =	**8.** 45 ÷ 100 =	**13.** 45 ÷ 1,000 =
4. 156 ÷ 10 =	**9.** 15.6 ÷ 100 =	**14.** 250 ÷ 1,000 =
5. 30.4 ÷ 10 =	**10.** 250 ÷ 100 =	**15.** 6,450 ÷ 1,000 =
6. .6 ÷ 10 =	**11.** 4.8 ÷ 10 =	**16.** 9,000 ÷ 1,000 =
7. 11.1 ÷ 10 =	**12.** 111 ÷ 100 =	**17.** 1,111 ÷ 1,000 =

18. A 100-pound tub of butter cost the grocer $48. What was the cost of a pound? of 10 pounds?

19. Ten tablets cost a stationer $.45. He sold them for $.70. The selling price of a tablet was how much more than the cost?

20. One hundred pounds of nails cost a hardware dealer $3.50. What was the cost a pound?

21. At the creamery 10 pounds of milk yielded .45 pound of butterfat. How much was this for a pound? for 100 pounds? for 1,000 pounds?

Holstein Cow — Jersey Cow

TWO MILK RECORDS

Mary had a prize-winning Jersey cow, and her brother, Harry, had a prize-winning Holstein. Each day they made a careful record of the amount of milk from each of their cows. Here is the record for one month. It contains the total weight of the milk a week and the price a hundred pounds (cwt.) paid by the creamery.

Week	Mary's Cow		Harry's Cow		Price	Total	
	lbs. Milk	Cwt.	lbs. Milk	Cwt.		Mary's Cow	Harry's Cow
1.......	245	2.45	274	?	$2.40	?	?
2.......	273	?	292	?	$2.40	?	?
3.......	280	?	300	?	$2.48	?	?
4.......	275	?	286	?	$2.48	?	?
Total	?	?	?	?	?	?	?

1. Copy this record. Each question mark (?) in the record stands for a question which you are to answer. Find the answer. Replace each question mark by its corresponding answer.

2. Who received the larger amount of money and how much, Mary or Harry?

3. Which cow gave more milk and how much more?

CHANGING FRACTIONS TO DECIMALS

It is almost always easier to work with decimals than with common fractions. This exercise will show you how to change common fractions to decimals.

1. Change $\frac{7}{8}$ to a decimal.

$8\overline{)7.000}$ = .875	To change a fraction to a decimal, divide the numerator by the denominator. Divide 7 by 8. Annex zeros until there is no remainder. Check: $.875 = \frac{875}{1000} = \frac{7}{8}$

2. Change these common fractions to decimals. Check your work.

$\frac{3}{5}$; $\frac{4}{5}$; $\frac{3}{8}$; $\frac{5}{8}$; $\frac{9}{12}$; $\frac{3}{4}$; $\frac{1}{4}$; $\frac{9}{15}$; $\frac{11}{20}$

In changing some common fractions there is a remainder after the work has been carried to three places.

3. $\frac{8}{9}$ = what decimal?

$9\overline{)8.000}$ = $.888\frac{8}{9}$	Here there is a remainder of 8 after the work has been carried to three places. The decimal is then written $.888\frac{8}{9}$. Usually the answer would be written .889, since $\frac{8}{9}$ is more than $\frac{1}{2}$. If the remainder had been 4, the answer would have been written .888, since $\frac{4}{9}$ is less than $\frac{1}{2}$.

4. Change these common fractions to decimals:

$\frac{2}{3}$; $\frac{5}{6}$; $\frac{1}{6}$; $\frac{9}{11}$; $\frac{8}{12}$; $\frac{9}{16}$; $\frac{7}{16}$; $\frac{7}{15}$

5. Copy the table on page 250 and change the fractions to decimals.

6. Find the answers to the questions in the exercise on page 250, using decimals instead of mixed numbers.

DECIMAL EQUIVALENTS OF EASY FRACTIONS

The following fractions are used very commonly in both the decimal and common fraction form. Learn the two forms of each.

$\frac{1}{2}$ = .5 or .50	$\frac{3}{5}$ = .6 or .60	$\frac{7}{8}$ = $.87\frac{1}{2}$ or .875
$\frac{1}{4}$ = .25	$\frac{4}{5}$ = .8 or .80	$\frac{1}{3}$ = $.33\frac{1}{3}$
$\frac{3}{4}$ = .75	$\frac{1}{8}$ = $.12\frac{1}{2}$ or .125	$\frac{2}{3}$ = $.66\frac{2}{3}$
$\frac{1}{5}$ = .2 or .20	$\frac{3}{8}$ = $.37\frac{1}{2}$ or .375	$\frac{1}{6}$ = $.16\frac{2}{3}$
$\frac{2}{5}$ = .4 or .40	$\frac{5}{8}$ = $.62\frac{1}{2}$ or .625	$\frac{5}{6}$ = $.83\frac{1}{3}$

1. An example like .75 × 96 can be worked in two ways.

With Decimals:

$$\begin{array}{r} 96 \\ .75 \\ \hline 4\,80 \\ 67\,2 \\ \hline 72.00 \end{array}$$

With Common Fractions:

$$\frac{3}{\cancel{4}} \text{ of } \overset{24}{\cancel{96}} = 72.$$

Which of these two ways is the easier?

Find these products. Use both methods as a check on your work.

2. .5 × 62 =	**13.** .8 × 75 =	**24.** $.66\frac{2}{3}$ × 21 =
3. $.12\frac{1}{2}$ × 120 =	**14.** $.16\frac{2}{3}$ × 54 =	**25.** .2 × 74 =
4. $.33\frac{1}{3}$ × 15 =	**15.** .25 × 84 =	**26.** $.62\frac{1}{2}$ × 48 =
5. .6 × 43 =	**16.** $.37\frac{1}{2}$ × 24 =	**27.** $.83\frac{1}{3}$ × 36 =
6. .125 × 24 =	**17.** .4 × 35 =	**28.** .75 × 28 =
7. $.87\frac{1}{2}$ × 16 =	**18.** .375 × 72 =	**29.** .625 × 64 =
8. 3.75 × 12 =	**19.** 5.625 × 168 =	**30.** $7.66\frac{2}{3}$ × 126 =
9. .5 × 16 =	**20.** $.33\frac{1}{3}$ × 27 =	**31.** .25 × 156 =
10. .25 × 700 =	**21.** $.66\frac{2}{3}$ × 60 =	**32.** .75 × 156 =
11. .75 × 800 =	**22.** $.12\frac{1}{2}$ × 64 =	**33.** $.33\frac{1}{3}$ × 180 =
12. .4 × 86 =	**23.** $.62\frac{1}{2}$ × 48 =	**34.** $.66\frac{2}{3}$ × 300 =

USES OF DECIMALS IN GOVERNMENT REPORTS

Decimal fractions are nearly always used in government reports. Common fractions seldom are found. The table below is part of one printed in a report of the Weather Bureau for a city in the United States.

	Average Temperature			
Month	1900	1910	1920	Average
January	33.2	32.4	24.1	?
March	35.0	44.7	40.6	?
May	60.8	60.2	57.8	?
July	76.4	77.8	72.5	?
September	70.8	68.4	67.4	?
November	48.7	41.6	44.2	?
Average for the 6 months	?	?	?	

1. In what month in each year was the temperature highest?

2. In what month was the temperature lowest each year?

3. Find the average temperature for the six months for each year.

4. In which months each year was the temperature below the average for the year? In which months was it higher than the average?

5. How much lower than the temperature for January 1910 was the temperature for January 1920? how much lower than the temperature for January 1900?

6. What was the average temperature for each month for the three years?

*__7.__ Make a copy of the table at the beginning of the exercise, but express the decimals as common fractions. Find the answers to questions **3** and **6**, using your own table. Which table is easier to work with?

USING DECIMALS IN DIVISION OF MIXED NUMBERS

1. You have learned how to divide $87\frac{1}{2}$ by 5. It is much easier to work this example using the decimal form.

$\begin{array}{r} 17.5 \\ 5\overline{)87.5} \end{array}$	Think: $87\frac{1}{2} = 87.5$ Divide as with whole numbers. Place the decimal point in the quotient directly over the decimal point in the dividend. Check: $17\frac{1}{2} \times 5 = 87\frac{1}{2}$

2. Divide $91\frac{1}{5}$ by 4. Think: $91\frac{1}{5} = 91.2$

3. Divide $16\frac{3}{4}$ by 5; by 15; by 25.

4. Divide $12\frac{3}{5}$ by 6; by 4; by 20; by 25.

5. Divide $1\frac{1}{4}$ by 5; by 2; by 25; by 25.

6. Divide $2\frac{4}{5}$ by 7; by 4; by 14; by 2.

7. Divide $4\frac{1}{2}$ by 9; by 3; by 2; by 15.

Find the quotients.

8. $62\overline{)198.4}$	**16.** $7.2\overline{)15.12}$	**24.** $26\overline{)8.508}$
9. $57\overline{)34.77}$	**17.** $5.4\overline{)491.4}$	**25.** $.114\overline{)254.22}$
10. $.63\overline{)57.96}$	**18.** $.74\overline{)62.16}$	**26.** $.21\overline{)196.812}$
11. $67\overline{)415.4}$	**19.** $26\overline{)182.78}$	**27.** $9.7\overline{)40.74}$
12. $9.3\overline{)306.9}$	**20.** $5.6\overline{)2279.2}$	**28.** $.55\overline{)390.5}$
13. $74\overline{)6.216}$	**21.** $.36\overline{)302.4}$	**29.** $.73\overline{)372.3}$
14. $2.5\overline{)375}$	**22.** $51\overline{)3.723}$	**30.** $1.25\overline{)312.5}$
15. $1.5\overline{).1695}$	**23.** $8.4\overline{)3,025}$	**31.** $.025\overline{)31.25}$

USING FRACTIONS TO COMPARE NUMBERS

Sometimes it is convenient to compare numbers, or sizes, without getting exact comparisons as you have been doing.

1. What do we mean when we say, "About $\frac{1}{2}$ hour" or "about $\frac{3}{4}$ of a mile"?

2. A coat costs \$10 and a hat costs \$4.95. About how many times as much as the hat does the coat cost?

3. Is \$4.95 about $\frac{1}{2}$ or $\frac{1}{4}$ of \$10?

4. What are the correct answers in the five problems below?

a. \$3.10 is about $\frac{1}{2}$; $\frac{1}{4}$; $\frac{1}{6}$ of \$6.
b. \$2.95 is about $\frac{1}{3}$; $\frac{1}{4}$; $\frac{1}{2}$; $\frac{1}{5}$ of \$15.
c. 30 is about $\frac{1}{4}$; $\frac{1}{5}$; $\frac{1}{2}$; $\frac{1}{6}$ of 149.
d. 58 is about $\frac{1}{2}$; $\frac{1}{4}$; $\frac{1}{5}$ of 220.
e. 52 is about $\frac{3}{7}$; $\frac{5}{7}$; $\frac{1}{3}$ of 70.

Fractions can be used to compare large numbers.

5. Is 990 about $\frac{1}{2}$ or $\frac{1}{3}$ of 2000?

Think: $\frac{990}{2000}$ is about $\frac{1000}{2000}$ or $\frac{1}{2}$ when reduced to lowest terms.

6. Compare 1,475 and 3,000.

Think: 1,475 is about 1,500. 1,500 is $\frac{1}{2}$ of 3,000. So 1,475 is about $\frac{1}{2}$ of 3,000.

7. Compare 2,850 and 9,000.

8. Compare 4,600 and 3,900.

9. The population of Town A is 15,000 and of Town B is 149,000. Express the comparison of the populations by a simple fraction.

Think: $\frac{15000}{149000}$ = approximately what simple fraction?

10. The area of Lake Placid is 3,490 square miles and of Lake Blue, 6,985 square miles. Express the comparison by a simple fraction: $\frac{3490}{6985}$ = approximately what?

COMPARING THE AREAS OF THE GREAT LAKES

1. Which of these five lakes is the largest?

2. Rank the lakes in the order of their size.

3. About how many times as large as Lake Erie is Lake Superior?

4. About how many times as large as Lake Ontario is Lake Michigan?

5. How does Lake Huron compare in size with Lake Superior?

6. In your geography book consult the table showing the area of the states. Which state is about equal in size to Lake Superior?

7. What states are approximately equal in area to each of the other lakes?

8. The area of the Mediterranean Sea is about 813,000 square miles. How many times as large as the total area of the great lakes is the area of the Mediterranean Sea?

9. How does the area of Lake Superior compare with the area of Rhode Island? of New York? of California? of Florida?

10. Is Lake Ontario equal to about $\frac{1}{2}$, $\frac{1}{3}$, or $\frac{1}{4}$ of Lake Michigan?

11. Is Lake Erie equal to about $\frac{1}{2}$, $\frac{1}{3}$, or $\frac{1}{4}$ of Lake Superior?

12. Is Lake Michigan about equal to $\frac{1}{2}$, $\frac{2}{3}$, or $\frac{5}{6}$ of Lake Superior?

*13. Use reference tables in your geography book to find a state that is about double the area of each of the lakes.

*14. Find a state that is about three times the area of each of these lakes.

A COMPLETION EXERCISE

In each of the following problems there is something missing. Number lines on your paper from 1 to 18. After each number write the word or number that is missing.

1. The decimal form of $\frac{3}{4}$ is ——.
2. The fractional form of .25 is ——.
3. .06 is read: six ——.
4. .025 is read: twenty-five ——.
5. $5\frac{1}{2}$ expressed in decimal form is ——.
6. 4.8 expressed as a mixed number is ——.
7. The inverted form of $\frac{5}{8}$ is ——.
8. The inverted form of $1\frac{2}{3}$ is ——.
9. The inverted form of 5 is ——.
10. When changed to an improper fraction, $4\frac{2}{3}$ equals——.
11. To change $\frac{7}{8}$ to a decimal —— 7 by 8.
12. To find what part 6 is of 15 divide —— by ——.
13. 25 is —— of 75.
14. The ratio of 8 to 4 is ——.
15. The ratio of 5 to 10 is ——.
16. $.5 \times .5 =$ ——.
17. The sum of .6, .7, and .7 is ——.
18. The difference between 4 and 3.25 is ——.

PRACTICE WITH DECIMALS

Add these numbers:

1. 4.7, 5.24, 6.78, 7.432, 5.1, .9

2. .01, 7.2, .465, 92.8, 74.12

3. 46.2, 8.3, .002, 4.96, 52

4. 4, .04, .4, .004, 44

Subtract these numbers. Work carefully.

5. 4.8 − 1.5 =

6. 5.63 − 4.27 =

7. .24 − .17 =

8. 13.6 − 4.25 =

9. 83.273 − 42.15 =

10. 5.241 − .47 =

Multiply these numbers. Watch the decimal points.

11. 1.4 × 21 =

12. 5.2 × .74 =

13. 9.6 × 30 =

14. .523 × 14 =

15. 63 × .007 =

16. 8.7 × 4.65 =

Divide these numbers. Watch the decimal points.

17. 37.5 ÷ 3 =

18. 4.84 ÷ 4 =

19. 7.46 ÷ .4 =

20. 8.55 ÷ .09 =

21. 6.224 ÷ .8 =

22. 27.08 ÷ 1.2 =

23. 6.75 ÷ 15 =

24. 11.025 ÷ 63 =

25. .169 ÷ .013 =

26. 5752.5 ÷ .025 =

ABOUT MAPLE SUGAR

Ned lived on a farm in Vermont. His father had a grove of sugar maples, or a "sugar orchard" as it is called there.

1. In sugar orchards there are, on the average, about 75 trees to the acre. In Ned's father's orchard there were 14 acres. About how many trees were there in the grove?

2. Ned found that it took a barrel of sap to make a gallon of sirup. A barrel contains 31.5 gallons. How many gallons of sap did it take to make 16 gallons of sirup? 28 gallons? 30 gallons?

3. A fair yield for a tree is $\frac{1}{2}$ gallon of sirup. Express $\frac{1}{2}$ as a decimal.

4. How many gallons would 100 trees yield at this rate?

5. A gallon of sirup makes about .65 pound of sugar. How many pounds of sugar will 80 gallons make?

6. One spring Ned found that 100 trees produced 329 pounds of sugar. What was the average yield a tree?

7. Ned received 26¢ a pound for this sugar. What did he receive for all of it?

8. What was the value of the average yield of Ned's 100 trees?

9. Some of the sap was made into sirup, put up into gallon cans, and sold for \$2.00 a can. The cans used cost \$.12 each. What was the net price Ned's father received for 65 gallons of sirup?

10. If this 65 gallons of sirup had been made into sugar, how many pounds of sugar would it have produced?

11. If this sugar had been sold for \$.25 a pound, what would Ned's father have received?

12. Use your answers to problems **9** and **11** to find out whether it was better to sell the product of the sugar orchard as sirup or as sugar.

13. Taking 1,050 as the number of trees in the sugar orchard and remembering that a tree yields, on the average, $\frac{1}{2}$ barrel of sap, find:

a. The number of barrels of sap produced in the orchard.

b. The number of gallons of sirup that this sap would make. (See problem **2**.)

c. How many pounds of sugar this sirup will produce.

DIAGNOSTIC TEST NO. II

1. $\frac{3}{4} + \frac{5}{6} + \frac{11}{12} = ?$

2. Subtract $14\frac{1}{5}$ from $85\frac{1}{10}$.

3. $4\frac{1}{2} \times 6\frac{2}{3} \times 5 = ?$

4. $5\frac{1}{3} \div 4 = ?$

5. Find the product of 584 and 975.

6. Divide 534,876 by 841.

7. Find $\frac{7}{8}$ of 50.

8. Change $3\frac{1}{2}$ feet to inches.

9. Find the area of a field 180 rods by 160 rods.

10. Find the average of 98, 75, 64, 52, and 186.

11. $18 = 72 \div ?$ $\qquad 3\frac{1}{2} = 7 \times ?$

12. $100 \times 3.5 = ?$ $\qquad 10 \times .605 = ?$

13. Find the sum of 7.8, .965, 47.9, and 86.74.

14. Subtract 8.625 from 62.1.

15. Multiply 7.24 by .95.

16. Divide 49.14 by 5.4.

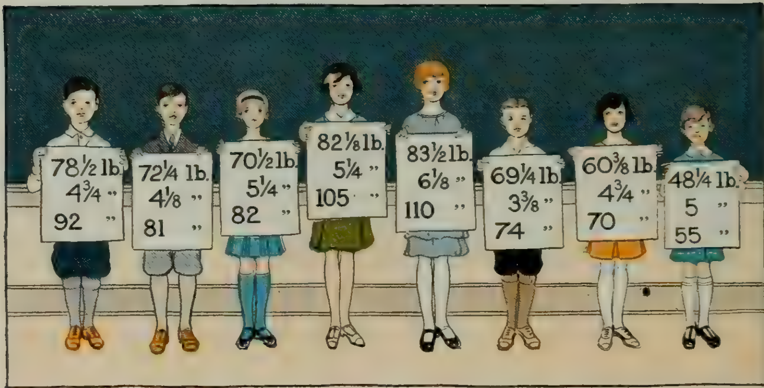
17. $.06 \times 100 = ?$

18. $.24 \times 300 = ?$

19. $1.05 \times 464 = ?$

20. Express $\frac{7}{12}$ as a decimal; .05 as a common fraction.

THE RESULTS OF A HEALTH PROGRAM



Two months ago these boys and girls were all underweight for their age and height.

The upper number shows what each weighed two months ago. The middle number shows what each has gained in the two months. The lower number on the card shows what each should weigh.

1. Find the present weight of each child. Make a table showing the weights.

2. How much more has each yet to gain in order to weigh just what he or she should? Make a table showing these amounts.

3. Which child made the greatest gain? How much more than each of the other children did she gain?

4. Which child gained the least? How much less than each of the other children did she gain?

5. Find the average gain a month for each child. Which child had the largest average gain?

*__6.__ Do you weigh as much as you should?

PRACTICE TESTS IN THE FUNDAMENTALS

You should be able to find the answers to the examples in each of the following sets and to check your work in the time allowed. When necessary to copy, do so before counting time.

Addition Test (8 minutes)

1.	2.	3.	4.	5.	6.
684	235	693	849	331	996
336	250	164	607	349	811
956	792	845	942	285	982
742	877	452	358	466	513
493	978	749	516	588	241
536	769	789	799	417	918

Subtraction Test (4 minutes)

1.	3.	5.	7.	9.	11.
9,317	9,361	7,493	8,802	8,921	9,727
4,432	4,327	2,628	1,326	5,896	2,030

2.	4.	6.	8.	10.	12.
9,322	8,362	8,431	5,244	8,510	7,456
3,345	1,799	4,988	2,579	5,889	4,679

Multiplication Test (8 minutes)

1.	3.	5.	7.	9.	11.
395	269	179	735	417	281
74	28	93	56	704	65

2.	4.	6.	8.	10.	12.
147	268	268	853	946	534
82	39	47	208	506	309

Division Test (8 minutes)

1. $46\overline{)16{,}422}$ **3.** $85\overline{)27{,}115}$ **5.** $39\overline{)28{,}509}$ **7.** $64\overline{)60{,}224}$

2. $27\overline{)10{,}395}$ **4.** $58\overline{)15{,}892}$ **6.** $98\overline{)49{,}784}$ **8.** $85\overline{)81{,}260}$

Use these tests for special practice from time to time.

PRACTICE TESTS IN FRACTIONS

You should be able to find the answers to the examples in each of the following tests in less than 10 minutes.

Addition Practice Test I

1. $\frac{1}{3}$ $\frac{1}{3}$	4. $\frac{3}{4}$ $\frac{3}{4}$	7. $\frac{2}{3}$ 7	10. $2\frac{1}{4}$ $\frac{1}{4}$ 4
2. $2\frac{3}{5}$ $3\frac{4}{5}$	5. $\frac{1}{2}$ $\frac{1}{6}$	8. $1\frac{1}{2}$ $\frac{3}{4}$	11. $1\frac{1}{4}$ $\frac{1}{4}$ $2\frac{1}{2}$
3. $\frac{1}{4}$ $\frac{1}{3}$	6. $\frac{3}{5}$ $\frac{1}{2}$ $\frac{1}{4}$	9. $1\frac{1}{6}$ $7\frac{3}{5}$ $3\frac{1}{6}$	12. $5\frac{3}{5}$ $7\frac{1}{4}$ $\frac{1}{4}$

Subtraction Practice Test I

1. $\frac{2}{3}$ $\frac{1}{3}$	3. $5\frac{5}{6}$ $\frac{1}{6}$	5. $3\frac{3}{4}$ $2\frac{3}{4}$	7. $1\frac{1}{4}$ $\frac{3}{4}$	9. $6\frac{1}{3}$ $\frac{2}{3}$	11. $4\frac{1}{6}$ $1\frac{5}{6}$
2. $6\frac{1}{4}$ $6\frac{1}{8}$	4. $7\frac{3}{5}$ $1\frac{1}{10}$	6. $7\frac{1}{9}$ $\frac{1}{4}$	8. $5\frac{1}{5}$ $\frac{2}{3}$	10. $\frac{3}{4}$ $\frac{1}{6}$	12. $4\frac{5}{6}$ $1\frac{2}{5}$

Multiplication Practice Test I

1. $\frac{1}{4} \times 8 =$	5. $\frac{5}{6} \times 14 =$	9. $8 \times \frac{1}{6} =$
2. $\frac{1}{2} \times \frac{7}{10} =$	6. $7 \times 4\frac{1}{2} =$	10. $2\frac{1}{4} \times \frac{1}{4} =$
3. $\frac{2}{5} \times 3\frac{2}{3} =$	7. $5\frac{3}{8} \times 6 \times 2\frac{1}{3} =$	11. $7\frac{1}{2} \times \frac{2}{5} =$
4. $6\frac{1}{4} \times 6\frac{2}{5} =$	8. $24 \times 3\frac{1}{8} =$	12. $23 \times 8\frac{2}{5} =$

Division Practice Test I

1. $5 \div \frac{1}{3} =$	**5.** $2 \div \frac{4}{5} =$	**9.** $\frac{13}{15} \div \frac{1}{2} =$
2. $1\frac{3}{8} \div \frac{3}{10} =$	**6.** $\frac{5}{6} \div 4 =$	**10.** $1\frac{1}{3} \div 5 =$
3. $4\frac{3}{5} \div 6 =$	**7.** $\frac{1}{6} \div 1 =$	**11.** $7 \div 12 =$
4. $1\frac{1}{5} \div 3\frac{1}{2} =$	**8.** $6\frac{2}{3} \div \frac{2}{3} =$	**12.** $3\frac{3}{8} \div 1\frac{1}{4} =$

Practice these tests until you can work all of the examples correctly in the time allowed.

PRACTICE TEST IN DECIMALS I

You should be able to find the answers to the following examples in less than 10 minutes.

1. Express as decimals: $\frac{1}{2}$; $\frac{1}{4}$; $\frac{7}{8}$; $\frac{4}{5}$.

2. Express as common fractions: .3; .25; .2; .125.

3. Find the sum of 8.6; 9.12; 5; .135; and 12.375.

4. Subtract: (*a*) 13.75 from 13.8; (*b*) 3.25 from 18.

5. Multiply: (*a*). 6 × 4; (*b*) 4.7 × 6.25; (*c*) 100 × 7.32.

6. Divide: (*a*) $3\overline{)7.296}$; (*b*) $.07\overline{)8.54}$; (*c*) $834\overline{)91.74}$.

Practice these examples until you can work all of them correctly in the time allowed.

PROBLEM SCALE II

1. A charitable lady divided 8 pies equally among 4 families. In one family there were 8 people. What part of a pie would each of these persons receive?

2. Jack wished to earn \$18.50 to buy a new bicycle. One Saturday he worked $7\frac{3}{4}$ hours for \$.40 an hour. How much more must he earn before he can buy the bicycle?

3. If Frank works for Mr. Smith $\frac{3}{4}$ of an hour before school and $1\frac{1}{2}$ hours after school each day, how many hours does he work for him during a school week? (5 days.)

Standards	
Excellent	9 or 10 correct
Good	7 or 8 correct
Fair	5 or 6 correct
Unsatisfactory . . .	0 to 4 correct

4. Harry had an order for $4\frac{1}{4}$ bushels of cherries. In the morning he picked $2\frac{3}{4}$ bushels and in the afternoon $3\frac{3}{4}$ bushels. How many more than he needed did he pick?

5. Before starting on a trip, Mr. Andrews filled the 10-gallon tank on his car. After a 50-mile trip he had $7\frac{1}{2}$ gallons. How many miles did his car travel using one gallon of gasoline?

6. Mrs. Andrews bought 3 chickens at the butcher shop. One weighed $3\frac{1}{4}$ pounds, one weighed $2\frac{3}{4}$ pounds, and one weighed $4\frac{1}{2}$ pounds. Find their average weight.

7. If $1\frac{3}{4}$ bushels of peas are needed to plant an acre, how much will the seed for a 10-acre field cost at $3 a bushel?

8. Jack gave half of the $4\frac{1}{2}$ pounds of pecans he had picked to Harry. If Harry already had $1\frac{1}{2}$ pounds of pecans, how many did he then have in all?

9. Mrs. Smith divided the candy from four $1\frac{1}{2}$-pound boxes equally among 8 children. How much did the candy weigh which each one received?

10. The average number of bushels of wheat an acre in the United States is $14\frac{1}{2}$. On a 10-acre field Mr. Smith raised 136 bushels of wheat. How much less an acre than the average was this?

CHAPTER III

ESTIMATING AND MEASURING LENGTH

1. Four boys measured the length of their classroom, each using his own method of measuring. One used a foot ruler, one a yardstick, one a piece of string, and one measured by counting the number of $2\frac{1}{2}$-foot steps it took him to walk the length of the floor. Try these four methods before you give your answer to the following questions. Which one measured the room the most accurately? Why?

2. Estimate the length of these lines in quarter inches. Then measure their length with a ruler. Find your error. Use this table to record your results. If your estimate is too long, mark your error +. If it is too short, mark your error −.

Line	Estimate	Measure with Ruler	Error
A			
B			
C			
D			

A ———————————————

B —————————

C —————————————

D ——————

3. Without a ruler, draw lines that you think are $1\frac{7}{8}$ inches, $5\frac{1}{2}$ inches, and $6\frac{3}{4}$ inches in length. Then measure them with a ruler. Use a table like the one in problem **2** to record your results.

4. Estimate the width and the height of the door in your classroom, the width of the blackboard, and the width of your desk. Then measure them and find your error.

*5. The *Santa Maria*, flagship of Columbus, was 128 feet long and 25 feet beam (width). Measure off a space 128 feet long and 25 feet wide.

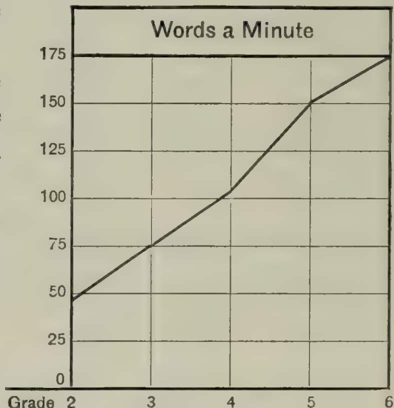
*6. Measure off a piece of ground that contains 160 square feet.

*7. Find a box and measure its inside dimensions. Then find its capacity.

*8. Estimate the area of the floor of your classroom. Check your estimate.

A SCHOOL GRAPH

This is a graph of the number of words which the children in the Hamson School read a minute.



1. For what grades are scores given on the graph?

2. Did the fourth grade read more rapidly than the third grade? How can you tell?

3. What grades read less than 100 words a minute?

4. What grades read more than 100 words a minute?

5. What grades read more than 125 words a minute?

6. How many words can you read in a minute?

*7. Find graphs in newspapers or secure some that are used in your school. Be ready to explain them to the class.

AN INTERURBAN TIME-TABLE

Harry lived near an interurban line. The cars passed his house every 10 minutes from 6:10 A.M. to 7:50 A.M., every 15 minutes from 7:50 A.M. to 3:50 P.M., and every 10 minutes from 3:50 P.M. to 6:30 P.M.

1. Make a schedule showing the time when the cars passed Harry's house between 6:10 A.M. and 6:30 P.M.

2. How many cars ran to the city each hour between 6:10 A.M. and 7:50 A.M.

3. How many cars an hour were there from 7:50 A.M. to 3:50 P.M.?

4. The trip to the railroad station took 25 minutes. When will each car reach the depot?

5. Harry's sister, who worked in the city, left the city at 5:45 P.M. When did the car reach her home?

UNITS OF TIME

By what unit of time would you measure:

1. the time in which a sprinter can run 100 yards?

2. the time it takes the earth to revolve around the sun?

3. the time you are in school each day?

4. the age of a man?

5. the age of a very young baby?

6. the length of time since Washington was born?

7. the length of time in which a racing automobile can travel a mile?

8. the time since the birth of Christ?

***9.** What ways were there of telling time before there were watches such as we have today?

WEIGHTS OF PORTIONS OF FOOD

1 cup butter	= $\frac{1}{2}$ lb.	1 pt. milk	= 1 lb.
1 cup corn meal	= $\frac{3}{8}$ lb.	1 cup raisins	= $\frac{3}{8}$ lb.
1 egg	= $\frac{1}{8}$ lb.	1 cup sugar	= $\frac{1}{2}$ lb.
1 cup flour	= $\frac{1}{4}$ lb.	1 qt. water	= 2 lb.

1. One cup of butter weighs —— pound more than 1 cup of flour.

2. One egg weighs —— pound less than 1 pint of milk.

3. One cup of raisins weighs —— pound less than 1 cup of butter.

4. A cup of sugar and a pint of milk together weigh —— pounds.

5. One quart of water weighs as much as —— pints of milk.

6. A cup of flour weighs —— pound more than an egg.

7. A quart of milk weighs —— pounds.

8. Two cups of flour weigh —— pound.

9. Two eggs weigh —— pound.

10. Two cups of sugar weigh —— pound.

11. One pound of raisins is about —— cups.

USEFUL MEASUREMENTS

Write the answers to the following examples:

1. 112 in. = ? ft.

2. 2 lb. = ? oz.

3. 1 mi. = ? yd.

4. 3 sq. yd. = ? sq. ft.

5. 1 cu. ft. = ? cu. in.

6. 2 t. = ? cwt.

7. 8 qt. = ? pt.

8. 16 ft. = ? yd.

9. 8 pk. = ? bu.

10. 5 min. = ? sec.

11. 1 sq. ft. = ? sq. in.

12. 7 yd. = ? ft.

13. $5\frac{1}{2}$ yd. = ? rd.

14. 2 rd. = ? ft.

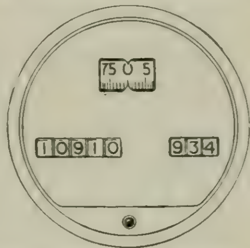
15. 27 cu. ft. = ? cu. yd.

16. 3 gal. = ? qt.

THE SPEEDOMETER

Jack made a copy of the readings of the speedometer on his father's automobile. This is the record for a week.

Total	Daily Readings			
10,384. . . .	0	0	0	Monday morning
10,471. . . .	8	7	3	Monday evening
10,562. . . .	9	1	5	Tuesday evening
10,646. . . .	8	3	4	Wednesday evening
10,734. . . .	8	7	9	Thursday evening
10,817. . . .	8	2	9	Friday evening
10,910. . . .	9	3	4	Saturday evening



1. Find in two different ways the total number of miles that the car was driven during the week. Do they check?

2. How many more miles was the car driven on Saturday than on Thursday?

3. What was the average number of miles that the car was driven daily during the week?

4. How many more miles must the car be driven before the speedometer will register 11,000 miles?

5. The car runs, on the average, 18.3 miles to a gallon of gasoline. How many gallons of gasoline were used on Tuesday? on Saturday?

6. If Jack's father drives the same number of miles each week as he did this week, how far will he drive in 10 weeks?

USING DECIMALS TO COMPARE

1. What is the ratio of the speed of a steamship which travels 25 miles an hour and the speed of a railroad train which travels 40 miles an hour?

$25 \div 40 = \frac{25}{40} = \frac{5}{8}$ $\frac{25}{40} = \frac{5}{8} = .625$	Think: What is the ratio of 25 to 40? This ratio may also be expressed as a decimal by changing $\frac{25}{40}$ to a decimal.

Express the following ratios as decimals.

2. The ratio of 6 pounds to 8 pounds = ?

3. The ratio of 9 pounds to 15 pounds = ?

4. The ratio of 6 pounds to 4 pounds = ?

5. The ratio of 12 pounds to 10 pounds = ?

6. Mary paid $.60 for the material in an apron. She sold the apron for $.90. What is the ratio of the cost of the material to the selling price of the apron?

7. Harry paid $1\frac{1}{4}$¢ for a *Journal* and sold it for 2¢. What is the ratio of the cost price to the selling price?

8. A grocer sold potatoes for $2.00 a bushel. He paid $1.60 for them. What is the ratio of the selling price to the cost?

9. What is the ratio of 6.25 hours to 3.125 hours?

10. About 12 bushels of potatoes are needed for seed for one acre. What is the ratio of the seed to a yield of 96 bushels an acre?

COMPARING CROPS

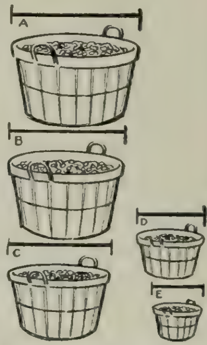
1. The wheat yield in bushels an acre in different countries is given at the right.

How many bushels an acre are produced by each of these countries?

2. How many more bushels an acre are raised in Belgium than in the United States? than in France?

3. How much less an acre is raised in the United States than in Great Britain?

4. Does the United States raise half as much an acre as Belgium?



Wheat yield an acre in bushels

A. Belgium 38.0
B. Germany....34.3
C. Great Britain and Ireland .31.3
D. France......20.4
E. United States 15.5

5. What country raises about two times as much wheat an acre as the United States?

*__6.__ How do the pictures of bushel baskets help show the facts about wheat?

BUYING AND SELLING BY WEIGHT

1. A load of hay contained 2,640 pounds. What did it sell for at $15 a ton?

To find how many tons there are in 2,640 pounds, divide that number by 2,000, the number of pounds in a ton, and carry the work to three places if necessary.

2. Find the value of 3,200 pounds of hay at $12.50 a ton.

3. A wagon load of coal contained 2,500 pounds. What is the value of the load at $18.40 a ton?

Think: Five hundred pounds = what part of a ton?

Express the following as tons and parts of tons. Use decimals or common fractions as seems best.

4. 2,400 lb.	**7.** 2,800 lb.	**10.** 3,000 lb.	**13.** 500 lb.
5. 2,560 lb.	**8.** 3,240 lb.	**11.** 6,754 lb.	**14.** 750 lb.
6. 2,250 lb.	**9.** 2,750 lb.	**12.** 3,250 lb.	**15.** 1,500 lb.

Find the cost of:

16. 800 lb. at $10 a ton.

17. 2,200 lb. at $18 a ton.

18. 3,500 lb. at $16.50 a ton.

19. 2,480 lb. at $17.50 a ton.

20. Find the value of three loads of coal at $13.50 a ton. The first load weighed 2,250 pounds, the second 2,375 pounds, and the third 3,650 pounds.

21. Ice was sold at the rate of 10¢ for a cake weighing 25 pounds. Find the cost of 500 pounds at this rate.

WORKING IN A FACTORY

In the Alexander Hamilton School the pupils are working problems about wages paid to men in factories. Tom, whose father works in the sash-and-door factory, reported the wages in this shop as follows:

Carpenters	$.935 an hour
Glaziers	1.03 an hour
Hardwood finishers	1.068 an hour

1. During the month of October the factory ran 9 hours a day. Find the total wages which a man in each of these three trades received during this month. (26 days.)

2. How much more than a glazier did a hardwood finisher receive a day? than a carpenter?

3. Mr. Jones, a carpenter, worked 46 hours one week. What was the amount of his pay check?

4. Mr. Smith, a glazier, worked full time one week. What was his wage that week?

5. Mr. Olson, a carpenter, received $39.27 as his weekly wage. How many hours did he work that week?

6. Mr. Wilson, a glazier, received $53.56 as his weekly wage. How many working hours was he idle during the week?

7. The men in this factory receive $1\frac{1}{2}$ hours pay for each hour they work overtime. What is the hourly wage for each of the classes of workmen for overtime work?

8. During one week Preston Olson, a carpenter, worked 54 hours time, and 3 hours overtime. What wages did he receive that week?

9. If the workmen in this factory work 9 hours a day, 309 days in the year, what will be the yearly earnings of men in each of these trades?

WEATHER PROBLEMS

1. On Monday at noon the thermometer registered 17° above zero. The next morning at 6:00 o'clock it registered 11° below zero. How many degrees did it fall in 18 hours? Draw a picture of a thermometer to show this.

2. During a flood a river rose 8.45 feet above high-water mark, and then in one day, because of the breaking of the dam and the levee, it fell to a point 1.25 feet below low-water mark. How many feet did it fall in one day? Draw a diagram to help you to find the answer.

3. At a Weather Bureau station the following was the record of rainfall during a week: Sunday, 1.2 inches; Monday, .5 inch; Tuesday, .03 inch; Wednesday, .003 inch; Thursday, .7 inch; Friday, 1.5 inches; Saturday, .8 inch. Find the total rainfall and the average daily rainfall for the week.

4. The ice on a pond was 5.45 inches thick on Monday evening, and 6.15 inches thick on Tuesday morning. How much thicker than on Monday evening was it on Tuesday morning?

5. The following were the temperature records at noon for one week: Sunday, 24.5°; Monday, 18.1°; Tuesday, 4.5°; Wednesday, 4°; Thursday, 5.4°; Friday, 32.5°; Saturday, 34°. What was the average noon temperature for the week?

6. How many degrees above the week's average was the temperature on Friday? How many degrees below the week's average was it on Wednesday?

***7.** Keep a record of the temperature outdoors at intervals of an hour from 8 A.M. to 8 P.M. Find the average temperature for the day.

DRAWING TO SCALE

This drawing represents a tennis court drawn to a scale of 24 feet to the inch. Use a ruler to find the answers to the questions below the diagram.

1″ = 24′

1. What is the width of the tennis court?

2. What is the length of the court? Look up the dimensions of a tennis court in a rule book on tennis. Were your measurements accurate?

3. Find the length from G to H.

4. Draw a tennis court to the scale of 1 inch to 12 feet.

5. What is the area of a tennis court expressed in square feet?

*6. Draw a plan of your playground to a scale.

*7. If there is a tennis court near your school, measure it to see if its dimensions are correct.

*8. What are the correct dimensions of a baseball diamond? Draw a plan of a baseball diamond to scale. Show the pitcher's box.

*9. What are the correct dimensions of a basket-ball court?

*10. Find the plan of a house drawn to scale.

EVERYDAY USES OF DECIMALS

1. A gallon of water weighs 8.36 pounds. A gallon of milk weighs 8.622 pounds. Find the difference in their weights.

2. How much more than 5 gallons of water do 5 gallons of milk weigh?

3. At the time of a flood in Arkansas, the water rose from 12.4 feet to 16.3 feet between 8 A.M. and 1 P.M. What was the average rise an hour?

4. After the water had reached its greatest height it was 27.7 feet deep. How much did it rise after 1 P.M.?

5. After the water began to fall, it fell 1.6 feet in 5 hours. How much did it fall an hour on the average?

6. A runner ran 100 yards in 10.5 seconds. How many yards a second was this?

7. Find the area of a farm 1.4 miles long and 1.5 miles wide. How many acres does it contain?

8. Here are the height and weight measurements of four children taken a year apart. Find the gains in weight and height for each child.

	Height (in.)			Weight (lb.)		
	First	Second	Gain	First	Second	Gain
Harry	57.2	58.6	?	85.4	91.2	?
Helen	56.7	56.9	?	78.3	82.3	?
Mary	59.8	61.0	?	98.5	106.7	?
Jack	46.0	47.9	?	60.1	71.0	?

9. An airplane flew at the rate of 124.6 miles an hour. How far will it fly in 1.7 hours at that rate?

10. The total rainfall in some parts of Arizona is about 10 inches a year. What is the average monthly rainfall?

REVIEW OF IMPORTANT POINTS

This exercise will help you to review the important points that you have learned about decimals.

1. Tell how to place the decimal points in adding decimals; in subtracting decimals.

2. How many decimal places must be pointed off in the product of .14 and 2.3? State the rule for such examples.

3. Write the examples below in the proper form to show how the decimal points should be shifted:

$3.2\overline{)17.5}$ $\quad$ $4.16\overline{)5.476}$ $\quad$ $.65\overline{)13}$ $\quad$ $3.42\overline{)273.6}$

4. Find the quotients of the examples in No. **3**.

5. Change $\frac{9}{15}$ to a decimal.

6. Find the product of .25 and 788 in two ways.

7. What is the correct quotient of $3\overline{).27}$? of $14\overline{).056}$?

FINDING DIFFICULTIES IN WORKING WITH DECIMALS

Some of the mistakes frequently made in working with decimals are given in the examples below. Explain what is incorrect in the work. Then work the examples correctly.

1. $\begin{array}{r} 1.4 \\ 2.75 \\ .08 \\ \hline 2.97 \end{array}$ $\quad$ **2.** $\begin{array}{r} .06 \\ .05 \\ .02 \\ \hline .011 \end{array}$ $\quad$ **3.** $\begin{array}{r} .4 \\ .6 \\ .5 \\ \hline .15 \end{array}$ $\quad$ **4.** $\begin{array}{r} 95.8 \\ 82.796 \\ \hline 13.100 \end{array}$

5. $8 - .5 = .3$ $\quad$ **6.** $.65 - .3 = .62$ $\quad$ **7.** $8 - .5 = .75$

8. $.2 \times .3 = .6$ $\quad$ **9.** $.2 \times .34 = .680$ $\quad$ **10.** $2 \times .12 = .024$

11. $.04 \times .6 = .0024$ $\quad$ **12.** $.05 \times 2 = 0.1$ $\quad$ **13.** $9.85 \div 5 = 197$

14. $\begin{array}{r} .4 \\ 4\overline{).16} \end{array}$ $\quad$ **15.** $\begin{array}{r} 3 \\ .25\overline{)7.5} \end{array}$ $\quad$ **16.** $\begin{array}{r} .7 \\ 1.2\overline{)8.4} \end{array}$ $\quad$ **17.** $\begin{array}{r} 0 \\ 75\overline{)60} \end{array}$

OUT WEST

1. Mr. Larson lives on a ranch in a western state. The land he owns is in the form of a rectangle $1\frac{3}{4}$ miles long and $1\frac{1}{2}$ miles wide. How many square miles does his ranch contain?

2. Check your answer to problem **1** by dividing the area of his ranch in square miles by the length of the ranch.

3. How many acres of land are there on the ranch? (1 sq. mi. = 640 A.)

4. Draw a map of Mr. Larson's ranch to the scale of 2 inches = 1 mile. How long will your map be? how wide? What will be its area in square inches?

5. Mr. Larson's nearest railway station is 1,536 miles from Chicago. What will a railway ticket from the station to Chicago cost at 3.6¢ a mile? Check your answer by dividing the cost of the ticket by 3.6¢.

6. The price of a railway ticket to New York from this station is $90.72. The rate is 3.6¢ a mile. How many miles is it from this station to New York? Check by multiplication.

7. The climate where Mr. Larson lives is dry and stimulating, warm in summer and cold in winter. One day last summer the thermometer stood at 82°. One day in winter it reached 38° below zero. What is the difference in degrees between these temperatures?

8. This western state has an area of 83,888 square miles and has an average of 5.85 peoole a square mile. What is the population of the state?

9. On a map of the United States the scale is 263 miles to the inch. A straight line from Mr. Larson's railroad station to Chicago is $5\frac{1}{4}$ inches long. How far is it in a straight line to Chicago? Prove your answer.

REVIEW OF DECIMALS

As a review of decimals, work the following examples. If you can do all of them quickly and correctly, you know how to work with decimals very well.

Copy the examples and find the answers:

1. $2.1 + 14.65 + 756.3 + .045 =$	**10.** $.75 \times .4 =$
2. $.7 + 147.8 + .004 + 5.47 =$	**11.** $6.41 \times .01 =$
3. $.964 + 579.3 + 4.82 + 100.01 =$	**12.** $.5 \times .03 =$
4. $985.42 - 756.37 =$	**13.** $7{,}790 \div 8.2 =$
5. $579.35 - 84.231 =$	**14.** $76.704 \div 96 =$
6. $436.1 - 35.268 =$	**15.** $14.307 \div .19 =$
7. $59.842 - 10.4 =$	**16.** $36.2 \div .47 =$
8. $65.32 - .001 =$	**17.** $.4224 \div .012 =$
9. $8.7 \times 6.4 =$	**18.** $.3756 \div 4 =$

19. Change to common fractions, or mixed numbers:

.9; .25; .075; $2.37\frac{1}{2}$; 1.4; .48; 3.8; 6.125

SPECIAL EXERCISE WITH HUNDREDTHS

How many of the following examples can you do correctly in 15 minutes?

I

1. $.25 + .75 =$	**11.** Does $\frac{3}{4}$ equal .75, .075, 7.50, or 75?
2. $.96 - .07 =$	**12.** Does $\frac{1}{2}$ equal .05, .005, 5, or .50?
3. $1. - .16 =$	**13.** Express $\frac{7}{10}$ as hundredths.
4. $.24 \times 75 =$	**14.** Subtract .65 from .8.
5. $.04 \times 100 =$	**15.** $1.25 \times 400 =$
6. $.07 \times 400 =$	**16.** $.4 \times .75 =$
7. $.05 \times 240 =$	**17.** $.04 \times 1{,}000 =$
8. $.03 \times 160 =$	**18.** Express .03 as a common fraction.
9. $.07 \times 200 =$	**19.** Express .17 as a common fraction.
10. $1.04 \times 300 =$	**20.** $1.25 \div .25 =$

II

Express $\frac{7}{8}$ as hundredths.

$.87\frac{1}{2}$ $8\overline{)7.00}$	To express $\frac{7}{8}$ as hundredths, change $\frac{7}{8}$ to a decimal, carrying the work to two places. There is a remainder of 4 after the work has been carried to two places. $\frac{4}{8} = \frac{1}{2}$. Therefore $\frac{7}{8} = .87\frac{1}{2}$.

1. Express each of the following fractions as hundredths:

$\frac{5}{8}$; $\frac{3}{8}$; $\frac{5}{6}$; $\frac{1}{6}$; $\frac{2}{3}$; $\frac{1}{3}$; $\frac{7}{25}$; $\frac{1}{25}$; $\frac{18}{25}$

2. Express the following fractions as hundredths. Remember that .1 is equal to .10.

$\frac{3}{10}$; $\frac{7}{10}$; $\frac{1}{5}$; $\frac{2}{5}$; $\frac{4}{5}$; $\frac{1}{4}$; $\frac{3}{4}$; $\frac{7}{20}$; $\frac{17}{20}$

3. Express the following as common fractions:

.05; .08; .20; $.12\frac{1}{2}$; .25; .75; .375; .625; .4

4. Express the following as hundredths:

.4; 1.5; 6.2; $.2\frac{1}{2}$; $.3\frac{1}{2}$; .1; .375; .875

3	9			VIA GRAFTON, W. VA., AND NEWARK, OHIO		12	528	4
Daily P.M.	Daily P.M.	Miles		(*Eastern Time*)		Daily A.M.	Daily A.M.	Daily P.M.
5.50	4.45	0.0	Lv	**New York, N. Y. (Penna. Sta.)**	Ar	8.04	6.50	12.40
5.42	4.30	0.0	Lv	**New York, N. Y. (Hudson Ter.)**	Ar	8.04	6.50	12.41
5.45	4.33	1.0	Lv	**Jersey City, N. J. (Exch. Pl.)**	Ar	8.01	6.47	12.38
5.52	4.52	——	Lv	**Newark (Park Place)**	Ar	8.02	6.40	12.30
a6.21	5.16	12.0	Lv	**Newark (Meeker Ave.)**	Ar	n7.35	p6.18	n12.08
a6.54	——	34.1	Lv	**Bound Brook, N. J.**	Ar	n7.08	n5.47	n11.43
8.01	6.42	86.9	Lv	**Wayne Jct., Pa.**	Ar	6.01	4.23	10.39
8.20	7.03	94.7	Lv	**Philadelphia**	Ar	5.36	3.58	10.17
b8.38	7.22	106.6	Lv	**Chester, Pa.**	Ar	r5.17	——	9.57
8.56	7.40	119.7	Lv	**Wilmington, Del.**	Ar	4.58	3.18	9.40
——	——	131.9	Lv	**Newark, Del.**	Ar	——	——	9.23
10.20	9.03	189.1	Lv	**Baltimore Md. (Mt. Royal)**	Ar	——	1.35	8.12
10.25	9.08	190.6	Ar	**Baltimore, Md. (Camden)**	Lv	3.20	1.25	8.07
10.32	9.12	190.6	Lv	**Baltimore, Md. (Camden)**	Ar	3.13	1.20	8.03
11.27	10.00	227.4	Ar	**Washington, D. C.**	Lv	2.20	12.25	7.15

PROBLEMS ABOUT RAILROADS

1. How many miles is it from Philadelphia to Washington by this railroad?

2. What is the fare between Philadelphia and Washington on this railroad at 3.6¢ a mile? Count a fraction of a mile as a mile.

3. What does a ticket from New York to Washington cost at 3.6¢ a mile?

4. How long does train No. 3, leaving New York at 5:50 P.M., take to make the trip to Washington? Express your answer in hours and minutes.

5. How long does it take train No. 9, leaving New York at 4:45 P.M., to make the trip from New York to Washington? Express your answer in hours.

6. What is the average speed an hour of train No. 9?

7. At Christmas time one year this railroad charged a fare and a half for the round trip.

a. How far is it from Newark to Washington?

b. What is the price of a one-way ticket between these cities at the regular price of 3.6¢ a mile?

c. What will the round trip cost at a fare and a half for the round trip?

8. Find the price of a ticket, at 3.6¢ a mile, from New York to each of the stations named on this time-table.

9. The railroads of the United States in a recent year had about 69,414 locomotives, 57,159 passenger cars, and 2,379,131 freight cars. They employed 1,751,324 persons, paying them wages amounting to $2,826,025,230 a year. Copy these numbers, telling what each represents; point them off correctly, and be able to read them.

10. The rails commonly used are 30 feet long and weigh about 90 pounds to the yard. Find the weight of a rail.

11. First estimate, and then find as accurately as you can, how many rails are used in building one mile of railroad.

12. Nearly all American railways are of standard gauge; that is, the width between rails is 4 feet, $8\frac{1}{2}$ inches. Express this distance in inches.

13. An average railroad locomotive burns 243 pounds of coal for every mile it runs. How many tons of coal will an engine burn on a 200-mile run?

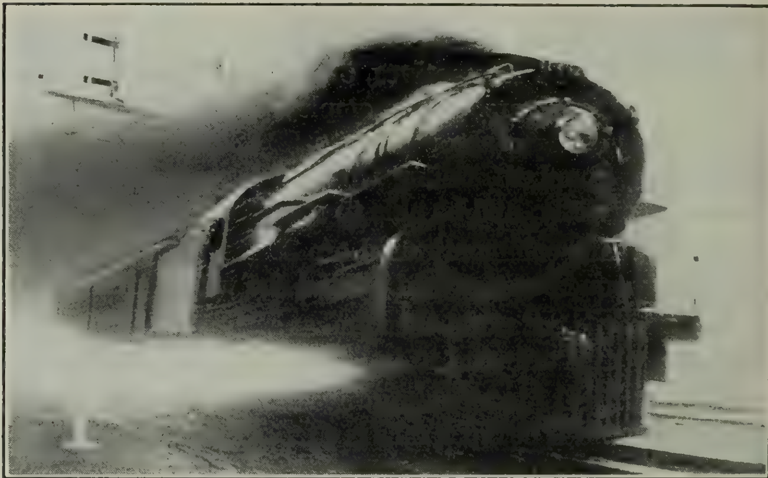
14. The coal cars used on a certain railroad hold 45.6 tons. How many tons of coal will a train consisting of 55 coal cars contain?

15. The Alexander Hamilton High School uses, on the average, 1,140 tons of coal a year. How many car loads of coal of 45.6 tons each will the Board of Education purchase annually for this building? What will the coal cost at $3.75 a ton?

16. A certain coal mine produced 726,850 tons of soft coal a year.

a. Counting 50 tons to the car load, how many car loads of coal did the mine produce in a year?

b. How many trains of 45 cars each will this make?



17. The Twentieth Century Limited on the New York Central Railway has an average speed of 50 miles an hour in going from New York to Chicago. The distance between New York and Chicago is 908.2 miles. Find the time in hours and minutes that it takes this train to make this run.

18. At 3.6¢ a mile, find the cost of a ticket from Chicago to New York.

19. Coal cars hold, on the average, 50.1 tons of bituminous coal. What is the weight of the coal in a train of 48 cars?

20. A stock car on a western railroad carries about 9.8 tons of hogs, or 10.2 tons of sheep. A train is made up of 24 stock cars loaded with hogs, and 22 cars loaded with sheep. How many tons of freight is this train carrying?

DIAGNOSTIC TEST NO. III

This exercise will test your ability to work different kinds of examples. If you have difficulty with any of the examples, practice on others like them.

1. $3\frac{1}{2} + 4\frac{1}{3} + 2\frac{1}{5} =$

2. $28 - 16\frac{1}{8} =$

3. Find the cost of $4\frac{3}{4}$ pounds of meat at \$.45 a pound.

4. $5 \div 8\frac{1}{3} =$

5. Find the sum of 28.5, 3.07, .6, and .175.

6. Subtract 3.856 from 7.

7. Find the product of 2.5 and 4.03.

8. Divide 62.5 by 2.5.

9. 9 = ? of 27. Express as a fraction, and as a decimal.

10. 1.5 lb. = ? oz.

11. *a.* $100 \times 6.5 =$ *b.* $10 \times .06 =$

12. *a.* $856 \div 100 =$ *b.* $74.3 \div 10 =$

13. *a.* $15 \times ? = 360$ *b.* $8\frac{1}{3} = 5 \times ?$

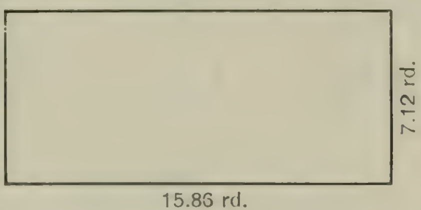
14. $160 = 2\frac{1}{2} \times ?$

15. $84 = .6 \times ?$

16. If the area of a field is 180 square rods and its length is 25 rods, what is its width?

17. Find the perimeter of the field at the right.

18. Find the area of the field.



19. $.03 \times 245 =$

20. $.25 \times 240 =$

21. Express $\frac{4}{5}$ as a decimal. Express .125 as a common fraction.

22. Find the volume of a box 8.2 inches long, 6.3 inches wide, and 8 inches deep.

PRACTICE TESTS IN FRACTIONS

You should be able to find the answers to the examples in each of the following sets in less than 10 minutes.

Addition Practice Test II

1. $\begin{array}{r} \frac{1}{8} \\ \underline{\frac{5}{8}} \end{array}$	4. $\begin{array}{r} \frac{4}{5} \\ \underline{\frac{2}{5}} \end{array}$	7. $\begin{array}{r} 4 \\ \underline{1\frac{2}{3}} \end{array}$	10. $\begin{array}{r} 3\frac{1}{5} \\ \underline{\frac{1}{5}} \end{array}$
2. $\begin{array}{r} 5\frac{5}{6} \\ \underline{2\frac{5}{6}} \end{array}$	5. $\begin{array}{r} \frac{1}{4} \\ \frac{1}{2} \\ \underline{\frac{1}{4}} \end{array}$	8. $\begin{array}{r} 3\frac{2}{3} \\ \underline{2\frac{1}{6}} \end{array}$	11. $\begin{array}{r} 7\frac{3}{4} \\ \underline{3\frac{1}{2}} \end{array}$
3. $\begin{array}{r} \frac{1}{3} \\ \frac{1}{5} \\ \underline{\frac{3}{10}} \end{array}$	6. $\begin{array}{r} 4\frac{1}{5} \\ \underline{1\frac{1}{4}} \end{array}$	9. $\begin{array}{r} 5\frac{1}{12} \\ \underline{\frac{5}{6}} \end{array}$	12. $\frac{5}{6} + \frac{3}{4} + \frac{5}{12} =$

Subtraction Practice Test II

1. $\begin{array}{r} \frac{5}{6} \\ \underline{\frac{1}{6}} \end{array}$	4. $\begin{array}{r} 5\frac{1}{4} \\ \underline{3} \end{array}$	7. $\begin{array}{r} 7\frac{5}{8} \\ \underline{2\frac{3}{8}} \end{array}$	10. $3 - 1\frac{2}{3} =$
2. $\begin{array}{r} 7\frac{1}{8} \\ \underline{\frac{5}{8}} \end{array}$	5. $\begin{array}{r} \frac{1}{2} \\ \underline{\frac{1}{4}} \end{array}$	8. $\begin{array}{r} 4\frac{1}{3} \\ \underline{\frac{1}{12}} \end{array}$	11. $\begin{array}{r} 2\frac{2}{3} \\ \underline{\frac{5}{6}} \end{array}$
3. $\begin{array}{r} 2\frac{3}{8} \\ \underline{\frac{1}{3}} \end{array}$	6. $\begin{array}{r} 3\frac{5}{8} \\ \underline{1\frac{1}{6}} \end{array}$	9. $\begin{array}{r} 3\frac{7}{8} \\ \underline{1\frac{11}{12}} \end{array}$	12. $\begin{array}{r} 7\frac{1}{5} \\ \underline{6\frac{3}{4}} \end{array}$

Multiplication Practice Test II

1. $\frac{1}{9}$ of $3 =$	5. $2 \times \frac{4}{9} =$	9. $8 \times \frac{1}{6} =$
2. $\frac{5}{9} \times \frac{3}{7} =$	6. $6 \times 3\frac{3}{4} =$	10. $3\frac{1}{6} \times 4 =$
3. $\frac{1}{4} \times 2\frac{1}{2} =$	7. $\frac{2}{3} \times 4\frac{3}{4} \times \frac{2}{3} =$	11. $6\frac{4}{5} \times \frac{3}{7} =$
4. $3\frac{3}{4} \times 3\frac{1}{3} =$	8. $\begin{array}{r} 36\frac{5}{6} \\ \underline{12} \end{array}$	12. $\begin{array}{r} 18 \\ \underline{4\frac{1}{2}} \end{array}$

Division Practice Test II

1. $5 \div \frac{2}{3} =$	**5.** $\frac{1}{7} \div \frac{1}{6} =$	**9.** $\frac{5}{6} \div \frac{3}{10} =$
2. $2\frac{5}{8} \div \frac{3}{4} =$	**6.** $5\frac{5}{9} \div 5 =$	**10.** $1\frac{1}{5} \div 4 =$
3. $\frac{1}{3} \div 1\frac{1}{2} =$	**7.** $8 \div 14 =$	**11.** $5 \div 2\frac{3}{4} =$
4. $1\frac{1}{3} \div 3\frac{1}{3} =$	**8.** $6\frac{1}{3} \div 2 =$	**12.** $9 \div 1\frac{1}{8} =$

Practice these examples until you can do them all correctly in the time allowed.

PRACTICE IN DECIMALS

1. Express as decimals: $\frac{1}{2}$, $\frac{2}{7}$, $\frac{3}{5}$, $\frac{5}{8}$.

2. Express as common fractions: .6, .25, .30, .875.

3. Find the sum of 8.24, 14, .6259, 18.6, .005.

4. Subtract:

$26 - .26 \qquad 26 - 2.6 \qquad 26 - .026$

5. Multiply:

$5 \times 1.6 \qquad .5 \times 16 \qquad .5 \times .16$

6. Divide:

$7\overline{)3.57} \qquad 7\overline{)35.7} \qquad 7\overline{).357}$

PRACTICE TEST IN DECIMALS II

You should be able to find the answers to the following examples in less than 10 minutes.

1. Express as decimals: $\frac{1}{5}$, $\frac{1}{8}$, $\frac{9}{20}$, $\frac{7}{25}$.

2. Express as common fractions: .05, .15, .1, .375.

3. Find the sum of 9.25, 15, 6.375, 1.5, and .002.

4. Subtract: (*a*) .04 from .14; (*b*) 6.15 from 91.2.

5. Multiply: (*a*) $4 \times .76$; (*b*) 24×1.2; (*c*) 1.25×7.5.

6. Divide: (*a*) $4\overline{)3.28}$; (*b*) $1.25\overline{)7.5}$; (*c*) $24\overline{)1.2}$.

Practice these examples until you can work all of them correctly in the time allowed.

PROBLEM SCALE III

1. Jack earns 18 cents an hour working in his father's garden. What does he earn in 9 hours?

2. Alice had \$5.40. She spent \$1.25 for a book. How much did she have left?

Standards	
Excellent	9 or 10 correct
Good	7 or 8 correct
Fair	5 or 6 correct
Unsatisfactory ..	0 to 4 correct

3. Jack's chickens eat $12\frac{1}{2}$ pounds of grain each week. How much do they eat in 20 weeks?

4. Apples are on sale at 4 pounds for 25 cents. What do 12 pounds cost?

5. A play yard is $9\frac{1}{3}$ feet by $10\frac{1}{2}$ feet. How many square feet is its area?

6. Mr. Smith bought 145 bushels of potatoes for \$1.25 a bushel. He sold them at \$1.49 a bushel. How much did he make?

7. Mrs. Smith uses $\frac{3}{4}$ pound of butter a day. How long will $7\frac{1}{2}$ pounds last?

8. A government report states that in a recent flood the water rose $16\frac{1}{2}$ inches in 3 hours. Find the average rise an hour.

9. A charitable lady divided 6 pies equally among 3 families for a Thanksgiving dinner. In one family there were eight people. What part of a pie would each of these persons receive if the pies were divided into equal parts?

10. Harry had an order for $2\frac{1}{2}$ bushels of cherries. In the morning he picked $1\frac{1}{4}$ bushels and in the afternoon $1\frac{3}{4}$ bushels. How many bushels more than he needed did he pick?

CHAPTER IV

SOME USES OF PER CENT

When the sixth-grade class of the Roosevelt School began the study of percentage, Miss Porter asked the pupils to tell her any uses of the words *per cent* that they knew or had heard outside of school. Here are some of the uses that were given. Can you add any others?

1. John said, "My per cent of attendance on my last report card was 98."

2. Mary said, "Last term 85 per cent of the pupils in our class were promoted."

3. Jane said, "The principal reported that 83 per cent of our class are members of the Junior Red Cross."

4. Arthur told the class that the bank paid 4 per cent interest on his savings account.

5. Two of the pupils told about a sale at which clothing was sold at a reduction of 15 per cent.

6. Henry showed that per cent was usually written with the sign %.

7. One of the boys said that per cent was used in finding the standings of teams in the school league.

8. Some of the pupils read paper clippings which contained something about per cent.

Miss Porter told the pupils that *per cent* is the word that business men use instead of the word hundredths.

MEANING OF PER CENT

Per cent means *hundredths.* $\frac{67}{100}$ as a decimal is .67: .67 is also written 67 per cent or 67%. Any fraction or decimal, that is expressed as hundredths, can be written as a per cent. The sign used for per cent is %.

25% means .25	25% of 40 means .25 × 40
8% means .08	8% of 50 means .08 × 50
4.5% means .045	4.5% of 64 means .045 × 64
$12\frac{1}{2}$% means $.12\frac{1}{2}$	$12\frac{1}{2}$% of 36 means $.12\frac{1}{2} \times 36$
20% means .20 or .2	20% of 50 means .20 × 50
100% means 1.00	100% of 50 means 1.00 × 50

100 per cent of anything means the whole of it.

The work you are to do in percentage will be easy because you will make use of much of what you have learned about decimals. Always remember that *per cent* means *hundredths.*

1. Change these per cents to hundredths:
28%; 65%; 8%; 7%; 15%; 20%; 40%; 50%; 125%; 200%

2. Is 5% equal to .5, 500, or .05?

3. Is 45% equal to .45, 450, or 4.5?

4. Is 60% equal to 60, .60, or .06?

5. Is 75% equal to .75, 7.5, or 7,500?

6. Is 150% equal to .15, 1.50, or 150?

7. How much less than 100 per cent of a number is 48 per cent of it?

Think: 100% − 48% = —%.

8. Sixty per cent of a class were boys. What per cent were girls?

Think: 100% − 60% = —%.

9. On a spelling test Alice's mark was 90%. What per cent of the words did she spell incorrectly?

FINDING A PER CENT OF A NUMBER

1. The school nurse reported that 20 per cent of the pupils in a class of 40 were absent because of illness. How many were absent?

20% of 40 = **.20 × 40 = 8**	Think: 20% of 40 = ? Express 20% as a decimal, .20. Then multiply 40 by .20.

2. Find 6% of $100.

Find:

3. 35% of 80	**6.** 20% of 90	**9.** 12% of 800
4. 75% of 64	**7.** 8% of 75	**10.** 95% of 640
5. 50% of 40	**8.** 4% of 125	**11.** 40% of 425

12. The school baseball team won 75% of the 16 games played. How many games were won?

13. Forty-five per cent of the pupils in the school were girls. There were 800 pupils in all. How many were girls?

14. What is 16% of 48?

15. 18% of 150 = .18 × 150	**21.** .75 × 64 = —% of 64
16. 22% of 160 = — × 160	**22.** .25 × 60 = —% of 60
17. 45% of 280 = — × 280	**23.** .58 × 65 = —% of 65
18. 6% of 250 = — × 250	**24.** .08 × 75 = —% of 75
19. 9% of 275 = — × 275	**25.** .04 × 175 = —% of 175
20. 150% of 80 = — × 80	**26.** .07 × 874 = —% of 874

27. Express the following as decimals:

6% 8% 20% 125% 140% 200%

28. Express the following as per cents:

.16 .25 .05 .08 1.28 1.6 1.10

PER CENTS AND HUNDREDTHS

During the month of November the sixth-grade class in the Adams School studied 100 words in spelling. Here is the record of part of the class:

	Correctly Spelled		Correctly Spelled
Harry	87 words	Richard	97 words
Jane	92 words	Mary	100 words
Arthur	67 words	Julia	93 words

1. Of the 100 words, how many words did Harry spell correctly? How many hundredths of the words was this? What per cent of the words did he spell correctly?

Think: 87 is what part of 100?
87 is $\frac{87}{100}$ of 100.
$\frac{87}{100} = .87 = 87$ per cent $= 87\%$.

2. How many hundredths of the words did Jane spell correctly? What per cent of the words did she spell correctly?

3. Who spelled 67% of the words correctly? 93%?

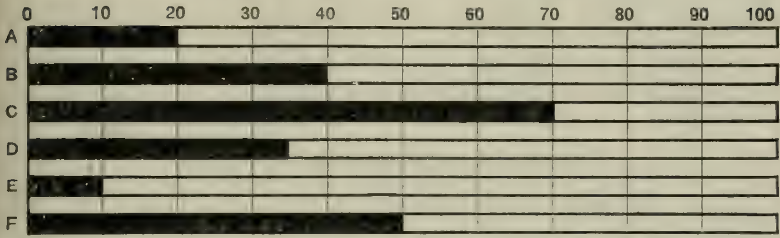
4. Who spelled 100% of the words correctly?

5. On an arithmetic test of 25 examples, Mary worked 18 correctly. What was the ratio of the number correct to the number in the test?

Think: The ratio of 18 to 25 $= 25\overline{)18.00}^{\;.72} = 72$ hundredths $=$ 72%. .72 or 72 per cent is the part of the examples Mary worked correctly.

6. On the same test of 25 examples, Jane had 22 correct. How many hundredths did Jane have correct? What per cent did she have correct?

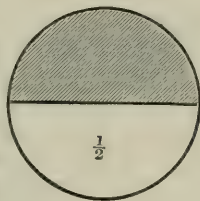
SHOWING PER CENTS BY GRAPHS



1. What per cent of each bar is shaded?

2. What per cent of each bar is not shaded?

3. Draw a figure showing four bars, one with 50% shaded, one with 40% shaded, one with 15% shaded, and one with 75% shaded.

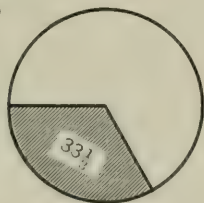


A

4. What per cent of circle *A* is shaded?

5. What per cent is not shaded?

6. What per cent of circle *B* is not shaded?



B

7. Draw a circle with 25% of it shaded.

8. Draw a circle with 75% of it shaded.

DIFFERENT WAYS OF EXPRESSING NUMBERS

You have learned that 25 per cent may be written in the decimal form as .25. It may also be written as the fraction, $\frac{25}{100}$, which, reduced to lowest terms, equals $\frac{1}{4}$.

$$25\% = .25 = \frac{25}{100} = \frac{1}{4}$$
$$75\% = .75 = \frac{?}{100} = ?$$

Express the following per cents in the three other forms given on page 323:

1. 15%	**4.** 60%	**7.** 50%	**10.** 35%
2. 20%	**5.** 80%	**8.** 70%	**11.** 5%
3. 40%	**6.** 30%	**9.** 36%	**12.** 10%

Using Fractions for Per Cent

You will often find it easier to use the fractional form instead of the decimal form. Study the following cases:

What is 25% of 488? This example can be worked in two ways:

The Decimal Form	The Fraction Form
$\begin{array}{r} 488 \\ .25 \\ \hline 24\,40 \\ 97\,6 \\ \hline 122.00 \end{array}$	$.25 = \frac{1}{4}$ $\frac{1}{\cancel{4}} \times \overset{122}{\cancel{488}} = 122$

Which of these two ways do you prefer? Why?

Learn the following fractional forms of the most commonly used per cents. When you know them perfectly, you can save much time in working problems.

$25\% = \frac{1}{4}$	$33\frac{1}{3}\% = \frac{1}{3}$	$40\% = \frac{2}{5}$
$75\% = \frac{3}{4}$	$66\frac{2}{3}\% = \frac{2}{3}$	$60\% = \frac{3}{5}$
$50\% = \frac{1}{2}$	$37\frac{1}{2}\% = \frac{3}{8}$	$80\% = \frac{4}{5}$
$20\% = \frac{1}{5}$	$12\frac{1}{2}\% = \frac{1}{8}$	$87\frac{1}{2}\% = \frac{7}{8}$

1. Give 25%, then 50%, then 75%, then 40% of the following: 100; 80; 40; 36; 96; 25; 75.

2. Give $12\frac{1}{2}\%$, $33\frac{1}{3}\%$, $66\frac{2}{3}\%$, 20%, and 60% of these numbers: 24; 48; 240; 60; 90; 360.

REDUCTIONS AT SALES

1. A dry goods store advertised a sale with reductions of 20%, 25%, $33\frac{1}{3}$%, and 50% on different kinds of cloth. What fractions have the same value as these per cents?

2. Find the reduction on a piece of cloth, regularly priced at \$8, marked 25% off.

3. What was the sale price of this piece of cloth?

4. Find the reduction and the sale price on a dress, regularly priced at \$40, and marked 20% off.

Find the missing numbers:

Regular Price	Per Cent Reduction	Reduction	Sale Price
5. \$100	20	\$20	\$80
6. \$200	25	?	?
7. \$300	$33\frac{1}{3}$	?	?
8. \$2.50	50	?	?
9. \$4.00	20	?	?
10. \$7.50	$33\frac{1}{3}$	?	?
11. \$9.00	25	?	?
12. \$8.69	50	?	?
13. \$15.00	20	?	?
14. \$8.73	$33\frac{1}{3}$	?	?
15. \$9.45	20	?	?

16. Which would be cheaper and how much, a \$40 dress sold at a reduction of $33\frac{1}{3}$ per cent, or a \$35 dress sold at a reduction of $\frac{1}{4}$ from the regular price?

17. Arthur bought a bicycle, listed in a catalogue at \$36, at a reduction of 5 per cent. What did the bicycle cost him?

18. Find the reduction on 6 yards of 40-cent material, on sale at a reduction of 25%.

PRACTICE WITH PER CENT

Practice with these per cents until you can find the answers in each set in less than 1 minute.

Set I

	a	*b*	*c*
1.	10% of 60 =	30% of 80 =	60% of 70 =
2.	20% of 80 =	40% of 80 =	80% of 100 =
3.	10% of 40 =	50% of 80 =	75% of 100 =

Set II

1.	6% of 100 =	7% of 600 =	9% of 200 =
2.	8% of 200 =	5% of 400 =	8% of 600 =
3.	9% of 400 =	3% of 600 =	4% of 500 =

Set III

1.	$12\frac{1}{2}$% of 80 =	$33\frac{1}{3}$% of 10 =	25% of 80 =
2.	$37\frac{1}{2}$% of 80 =	$33\frac{1}{3}$% of 90 =	25% of 400 =
3.	$62\frac{1}{2}$% of 80 =	$66\frac{2}{3}$% of 90 =	25% of 100 =

Set IV

1.	75% of 200 =	20% of 60 =	75% of 300 =
2.	40% of 125 =	25% of 160 =	$33\frac{1}{3}$% of 120 =
3.	60% of 250 =	20% of 40 =	$66\frac{2}{3}$% of 300 =

Set V

1.	25% of 400 =	$12\frac{1}{2}$% of 400 =	8% of 125 =
2.	6% of 150 =	8% of 250 =	75% of 400 =
3.	$37\frac{1}{2}$% of 800 =	$37\frac{1}{2}$% of 1,200 =	4% of 125 =

Set VI

1.	25% of \$100 =	6% of \$150 =	$33\frac{1}{3}$% of \$960 =
2.	75% of \$200 =	50% of \$186 =	$37\frac{1}{2}$% of \$800 =
3.	10% of \$12.50 =	$12\frac{1}{2}$% of \$160 =	60% of \$500 =

A LESSON ON PER CENT

A principal placed this notice on the bulletin-board. It shows the number of pupils in each grade and the per cent who joined the Junior Red Cross.

GRADE	NO. IN GRADE	PER CENT WHO JOINED
1.....	50	54%
2.....	40	60%
3.....	40	65%
4.....	45	80%
5.....	35	60%
6.....	36	75%

The sixth-grade class used the bulletin for a lesson in arithmetic. Below are some of the problems that were made from the table.

1. What class had the largest per cent of memberships?

2. What per cent in each class did not join?

3. How many pupils in each class became members?

4. How many did not become members? Find this in two ways.

5. What was the average per cent who joined the Junior Red Cross?

6. How many per cent less of third-grade children than of fourth-grade children joined the Junior Red Cross?

ABOUT PER CENTS

1. Does per cent mean the same as hundredths?

2. .25 may be written —— per cent.

3. 15% may be written $\frac{\quad}{100}$.

4. Are $\frac{17}{100}$ and .17 equal in value?

5. 5% in its decimal form is ——.

6. The fractional form of 9% is ——.

7. What part of a number is 100 per cent of it?

8. .4 equals —— per cent.

BATTING AVERAGES

A school baseball team kept a record of the hits made by the players. They wished to select the best batter according to the method used in the big leagues. One of the boys asked a player how this was done. He was told to divide the number of hits by the number of times at bat, and to carry the work to three places. He illustrated by taking Ruth's record for 1922.

	Games	At Bat	Hits	Average
Ruth........................	152	520	205	.394

205 (hits) ÷ 520 (at bat) = .394. Show the work. Why is the answer a decimal?

1. Here is a record of a school baseball team according to the batting order. Find the batting average of each player. Which player had the best average?

Name	Position	Games	A. B.	Hits	Average
John..................	s s	14	70	19	?
Harry..................	2 b	14	72	18	?
Sam..................	l f	12	62	21	?
George..................	c f	14	76	34	?
Jack..................	r f	14	71	7	?
Keith..................	1 b	13	68	19	?
Dick..................	3 b	14	69	8	?
Leo..................	c	12	59	15	?
Carl..................	p	14	77	25	?

***2.** Look up batting averages in the baseball rule book or in daily newspapers. Check some of them.

LEARNING TO USE PER CENTS FOR DECIMALS

You have learned that per cent means hundredths. .75 = 75 per cent = 75%.

1. Read .125 as a per cent.

.125 can be written as 12.5 hundredths or 12.5%.

.125 can also be written as $.12\frac{1}{2}$ or $12\frac{1}{2}\%$.

In the number 12.5%, $\frac{1}{2}\%$ is expressed as .5%.

2. Read .375 as a per cent.

3. Express the following as per cents:

.625; .875; .0625; .3125; .0475; .086.

4. Write the fractions in the following per cents as decimals:

$12\frac{1}{2}\%$; $37\frac{1}{2}\%$; $16\frac{1}{4}\%$; $7\frac{3}{4}\%$; $9\frac{4}{5}\%$; $4\frac{7}{8}\%$.

5. Copy this table and write the missing numbers. Express the decimals as hundredths.

Fractions	Decimals	Per Cent	Decimals	Fractions	Per Cent	Per Cent	Decimals	Fractions
$\frac{1}{2}$			.4			5%		
$\frac{1}{4}$			.8			8%		
$\frac{1}{8}$			.12			4%		
$\frac{1}{3}$			.15			10%		
$\frac{3}{5}$			1.25			16%		
$\frac{3}{8}$			.45			20%		
$\frac{3}{4}$			1.05			1%		
$\frac{2}{3}$			.35			24%		
$\frac{1}{25}$			.01			75%		
$\frac{1}{20}$			.15			90%		
$\frac{1}{10}$			4.5			95%		
$\frac{1}{100}$			.005			100%		
$\frac{1}{300}$			.001			105%		
$\frac{1}{200}$			.002			150%		
$\frac{1}{500}$			1.01			200%		

FINDING WHAT PER CENT ONE NUMBER IS OF ANOTHER

1. On a stormy day only 25 children out of a class of 40 were at school. What per cent of the children were present?

$.62\frac{1}{2} = 62\frac{1}{2}\%$ $40\overline{)25.00}$ $24\,0$ $1\,00$ 80 20 $\frac{20}{40} = \frac{1}{2}$	To find what per cent were present, find how many hundredths 25 is of 40. $\frac{25}{40}$ = ? hundredths. Carry the quotient to two places as shown at the left. $.62\frac{1}{2}$ of the children or $62\frac{1}{2}\%$ were present. $62\frac{1}{2}\%$ may also be written 62.5%.

2. On another day 30 of the children were present. What was the per cent of attendance?

3. The teacher of another class placed the following table on the blackboard and asked the children to figure the per cent of attendance for each day and the per cent for the entire week. Complete the table.

	Number Enrolled	Number Present	Per Cent Present
Monday	40	40	?
Tuesday	40	36	?
Wednesday	40	35	?
Thursday	40	37	?
Friday	40	39	?
Total	?	?	?

4. On what day was the per cent of attendance the largest?

***5.** Make a table like this for your own class for one week.

SCHOOL MARKS

1. On a spelling test of 50 words, Harry misspelled 10. What was his per cent of accuracy?

2. On an arithmetic test of 12 examples, Harry had 10 correct, and John had 8. How much higher than John's was Harry's per cent of accuracy?

3. On a spelling test of 25 words, what per cent should be subtracted for each word missed? on a test of 20 words?

4. On a test of 20 words, Mary spelled 60% correctly. How many words did she misspell?

5. On a reading test of 15 questions, Mary had 20% incorrect. How many questions did she have correct?

6. The passing mark in a geography class was 75%. On a test of 45 questions Harry missed 10. Did he pass the test?

7. Children with a per cent of attendance of less than 90 were asked to report to the principal's office. Which of the following children would have to report?

	Days Present	Days Absent	Total Days	Per Cent of Absence
Mary	49	21	?	?
Harry	65	5	?	?
Kate	69	1	?	?
Peter	58	12	?	?
John	63	7	?	?

8. What per cent of the answers to the first 7 problems did you have correct?

*__9.__ On your next test find what per cent you have correct.

*__10.__ Find your own per cent of attendance for last month and the per cent of attendance for the class.

PRACTICE IN FINDING WHAT PER CENT ONE NUMBER IS OF ANOTHER

1. 5 = —% of 10	**14.** 16 = —% of 160
2. 6 = —% of 12	**15.** $\frac{1}{4}$ = —% of $\frac{1}{2}$
3. 9 = —% of 18	**16.** .4 = —% of 2.8
4. 2 = —% of 8	**17.** 9 = —% of 100
5. 4 = —% of 20	**18.** 6 = —% of 300
6. 5 = —% of 25	**19.** 5 = —% of 30
7. 9 = —% of 27	**20.** $\frac{1}{2}$ = —% of 25
8. 6 = —% of 9	**21.** 100 = —% of 240
9. 8 = —% of 12	**22.** 250 = —% of 800
10. 9 = —% of 15	**23.** 300 = —% of 1,000
11. 8 = —% of 64	**24.** 750 = —% of 475
12. 12 = —% of 15	**25.** 600 = —% of 480
13. 18 = —% of 18	**26.** $3\frac{1}{2}$ = —% of 5

FRACTIONS, DECIMALS, AND PER CENTS

Complete these examples in the same way that the first one is worked. Do the work without a pencil.

1. 4 is $\frac{1}{4}$, .25, 25% of 16.	**7.** 6 is —, —, —— of 8.
2. 3 is —, —, —— of 12.	**8.** 9 is —, —, —— of 12.
3. 2 is —, —, —— of 10.	**9.** 2 is —, —, —— of 16.
4. 6 is —, —, —— of 24.	**10.** 6 is —, —, —— of 16.
5. 8 is —, —, —— of 16.	**11.** 20 is —, —, —— of 100.
6. 5 is —, —, —— of 15.	**12.** 16 is —, —, —— of 20.

Complete these examples in the same way. Use pencil. Express the decimal form as hundredths.

13. 18 is —, —, —— of 54.	**17.** 39 is —, —, —— of 117.
14. 24 is —, —, —— of 60.	**18.** 22 is —, —, —— of 121.
15. 60 is —, —, —— of 96.	**19.** 114 is —, —, —— of 152.
16. 30 is —, —, —— of 144.	**20.** 75 is —, —, —— of 125.

TESTING SEEDS

1. Harry planted 20 kernels from an ear of his prize corn, and 18 of them sprouted. What per cent of the kernels sprouted?

2. He tested another ear by planting 25 kernels. Of these, 21 sprouted. What per cent of the kernels of corn sprouted? What per cent did not?

3. How many more kernels a hundred sprouted on the second ear than on the first?

4. To find how much better than ordinary corn his prize corn was, he tested three ears of ordinary corn by planting 25 kernels from each ear in separate boxes. In one box 10 sprouted, in another 7, and in the other 6. What per cent of the kernels in each box sprouted? What per cent of the seeds in the three boxes sprouted?

5. What was the difference in per cents between the prize corn and the ordinary corn?

6. A class studying plants tested some cabbage seeds by planting 12 of them in a box. Of these, 9 sprouted. What per cent sprouted? What per cent did not sprout?

7. If you were testing two kinds of seeds and one tested 75% and the other 90%, which would you use? Why?

***8.** Test some seeds to see what per cent of them will sprout.

***9.** How may a farmer select good seeds for the next year's planting?

PER CENTS LARGER THAN 100

Sometimes per cents larger than 100% are used.

1. Mary's baby brother weighed 6 pounds when he was born. At the end of 6 months, he weighed 14 pounds. His weight at the end of 6 months was what per cent of his birth weight? What per cent of 6 pounds is 14 pounds?

> $14 = ?\%$ of 6.
>
> To find what per cent 14 lb. is of 6 lb., divide 14 by 6. $14 \div 6 = 2\frac{1}{3}$. When reduced to hundredths, $2\frac{1}{3}$ equals $2.33\frac{1}{3}$ or $233\frac{1}{3}\%$.

2. Fifteen pounds is what per cent of 10 pounds? of 7.5 pounds?

3. The children in the picture at the top of this page were weighed and their heights recorded at birth. Now they are again being weighed and measured by the school nurse. Their records appear in the following table. Find the per cent gain in weight and height for each child.

Child	Height		Per Cent Gain	Weight		Per Cent Gain
	at Birth	Today		at Birth	Today	
Susan....	21	41		8	36	
Max.....	20	38		$7\frac{1}{2}$	32	
Betty....	19	39		$6\frac{3}{4}$	33	
Sam....	$22\frac{1}{2}$	40		$7\frac{1}{4}$	35	

VALUES OF PER CENTS

I. One hundred per cent of anything is equal to the whole of it. For example: 100% of 35 = 1.00 × 35 = 35.

II. Less than 100 per cent of a number is equal to less than the number. Show how this is true.

III. More than 100 per cent of a number is more than the number. Show how this is true.

Which of the following per cents of a number are more than the number? Which are less than the number? In each case gave the reason.

1. 84% **4.** $33\frac{1}{3}$% **7.** 140% **10.** 6.25%
2. 62% **5.** 75% **8.** $100\frac{1}{2}$% **11.** 283%
3. 184% **6.** 63.4% **9.** $5\frac{1}{4}$% **12.** 428%

Use fractional forms (page 324) in working the following examples:

13. Give 50% of the following: 8; 16; 34; 50; 24; 96; 500.

14. Give 25% of 16; 28; 4; 12; 36; 64; 108.

15. Give 125% of each number in examples **13** and **14**; give 200% of each number.

WEIGHING SCHOOL CHILDREN

In Jefferson School the nurse weighs the children to find if they are at normal weight. If they are more than 10 per cent below normal weight for their age and height, she reports this to the parents. This is the way she finds the per cent that a child is underweight.

1. John weighs 96 pounds. The normal weight for his age and height is 100 pounds. What per cent is he underweight?

> Think: 100 lb. − 96 lb. = 4 lb. underweight.
>
> Per cents of underweight and overweight are always figured on the normal weight.
>
> Think: 4 lb. is ?% of 100 lb. 4 ÷ 100 = .04 or 4%.

2. Harry weighs 108 pounds and his normal weight is 100 pounds. How much is Harry overweight? What per cent is this of his normal weight?

3. Here are the weights of six of Harry's classmates and their normal weights. Find what per cent each one is of normal weight, and what per cent each is over- or underweight. Mark per cents of overweight +, and per cents of underweight −. Copy the table neatly.

	Weight	Normal Weight	Per Cent of Normal	Per Cent Over- or Underweight
Arthur	94 lb.	100 lb.	?	?
Kate	110 lb.	100 lb.	?	?
John	102 lb.	120 lb.	?	?
Peter	150 lb.	125 lb.	?	?
Mary	$137\frac{1}{2}$ lb.	125 lb.	?	?
James	105 lb.	125 lb.	?	?

4. Which children are more than 10 per cent underweight?

***5.** Are you underweight or overweight?

PRACTICE WITH PER CENTS

You have learned two of the main uses of per cent:

I. Finding a per cent of a number:

$$4\% \text{ of } 25 = .04 \times 25 = 1.$$

II. Finding what per cent one number is of another: 1 is what per cent of 25?

$$1 \div 25 = .04 \text{ or } 4\%.$$

Find the answers to the following examples. If you need help, review the work in percentage that you have had up to this point.

1. What is 6% of 250?
2. Find what per cent 10 is of 40.
3. What per cent of 15 is 10?
4. What is 8% of 326?
5. What per cent of 64 is 48?
6. Find how much 15% of $3,000 is.
7. Find what per cent 36 is of 108.
8. Find 5% of 125.
9. Find 125% of 16.
10. What per cent of 175 is 35?
11. Find 200% of 15.
12. How much is 75% of 80?

Supply the missing numbers:

13. 3 = —% of 6
14. 6 = —% of 12
15. 7% of 100 = —
16. 6 = —% of 18
17. 7 = —% of 21
18. 8% of 50 = —
19. 25 = —% of 100
20. 9 = —% of 36
21. 4% of 250 = —
22. 12 = —% of 60
23. 20% of 60 = —
24. 20% of 16 = —
25. — = 6% of 30
26. 18 = —% of 36
27. 3% of 125 = —
28. 30 = —% of 75
29. 2 = —% of 100
30. 8 = —% of 6
31. $66\frac{2}{3}$% of 40 = —
32. 80 = —% of 40
33. 40 = —% of 32
34. 4 = —% of 40
35. 7% of 40 = —
36. 80% of 75 = —

USING ROUND NUMBERS

In using large numbers, when exact figures are not required, we drop figures of little importance and write 0's in their places. When we say that there are 117,000,000 people in the United States, we use 0's to the right of the millions because exact figures are not important.

1. What would be an easy way to read these numbers as round numbers?

10,147 65,743 11,475,964

2. In which of the following statements are we speaking in round numbers?

a. He earned a few hundred dollars.

b. The bank had deposits amounting to $498,763.21.

c. In the battle 10,000 men were killed and wounded.

d. On the *Leviathan*, there were 7,500 soldiers.

e. There were 995,000 people in Detroit in 1920.

f. The freight car contained 1,257 bushels of wheat.

g. Thousands of people were present.

REVIEW OF DECIMALS

Practice giving the answers to these examples until you can do the work easily:

1. $.4 + .5 + .2 =$	**11.** $8.1 \div .9 =$
2. $9.1 - .8 =$	**12.** $3.2 \div .04 =$
3. $.5 \times 6 =$	**13.** $5.1 + .07 =$
4. $.8 \div 4 =$	**14.** $8.6 - .05 =$
5. $1.2 + 2 =$	**15.** $9 - .001 =$
6. $4.2 - 1.2 =$	**16.** $\$4.50 \div \$.09 =$
7. $.3 + .4 =$	**17.** $\$7.20 \div \$.80 =$
8. $6 \times 1.2 =$	**18.** $\$2.50 \div 50 =$
9. $4.5 \div 5 =$	**19.** $\$4.80 \div 12 =$
10. $9.0 + .5 =$	**20.** $3.7 + 1.3 =$

A COMPLETION TEST

Study this exercise carefully. Be ready to give the correct answers either orally or in writing.

1. $\frac{3}{4}$ expressed as a decimal is ——.
2. .45 expressed as a common fraction is ——.
3. 25% expressed as a decimal is ——.
4. To find 8% of 64, multiply —— by ——.
5. To find what per cent 8 is of 64 —— 8 by ——.
6. 2 is —% of 4.
7. 50 is —% of 100.
8. 7% of $200 is ——.
9. 8% of 75 is — × 75.
10. 25% of 200 is ——.
11. 30 is —% of 120.
12. 3.6 cents is $ ——.
13. 125% of 40 is — × 40.
14. $33\frac{1}{3}$% equals the fraction —.
15. 174 is —% of 100.
16. $\frac{7}{8}$ is —%
17. $\frac{4}{5}$ is —%.
18. $\frac{19}{100}$ is —%.
19. 3 inches is —% of a foot.
20. .8 is —%.

PRACTICE WITH PER CENTS

Supply the missing numbers:

1. 125% of 20 = —
2. $33\frac{1}{3}$% of 27 = —
3. 6% of 100 = —
4. 5% of 20 = —
5. 25 = —% of 20
6. 8 = —% of 100
7. 150% of 20 = —
8. 40% of 50 = —
9. 12 = —% of 15
10. 48 = —% of 72
11. 35% of 180 = —
12. 46% of 320 = —
13. 52 = —% of 25
14. 16 = —% of 50
15. 63 = —% of 72
16. 45 = —% of 72
17. 115% of 480 = —
18. 25% of 320 = —
19. 9% of 48 = —
20. $3\frac{1}{2}$% of 500 = —
21. 60 = —% of 72
22. $4\frac{1}{2}$% of 200 = —

BOY SCOUTS AND THEIR TESTS

Jack, who is in the sixth grade, is a member of the Boy Scouts. He is training Tom, who is a "tenderfoot." Jack, who is a "second class scout," knows a great deal about scouting. Here are some of the things that he has told Tom:

1. A full boy scout troop consists of 32 boys. It is divided into four equal patrols. What part of a troop is a patrol? How many boys are there in a patrol if the troop is a full one?

2. The Boy Scouts of America was organized in 1910. How long ago was this?

3. In a scout camp there were 8 boy scout troops. Two of them had 32 boys each, 3 had 30 boys each, 2 had 28 boys each, and one had 24 boys. What was the total number of scouts in the camp? What was the average number of boys in a troop?

4. A second-class boy scout must be able to go a mile in 12 minutes at the scout's pace. How many feet a minute must a second-class boy scout go on the average? how many in a second? (1 mi. = 5,280 ft.)

5. A first-class boy scout is able to send by semaphore a message of 30 letters in a minute. At this rate how long would it take a boy scout to send by semaphore the letters in the first verse of "America"?

6. A boy scout must make a trip alone, or with one other boy scout, to a point at least 7 miles away, either walking or rowing a boat. Jack walked alone to a place $7\frac{3}{4}$ miles away from his home and returned over the same road. How many miles did he walk?

7. He started at 6 o'clock Saturday morning and returned at 4:15 P.M. How many hours was he away on his trip? how many minutes?

8. A scout must be able to judge distance, size, number, height, and weight within 25%. Jack was asked to estimate the height of a tree. He said 66 feet. The true height was 72 feet. Was Jack's estimate within 25% of the true height?

Think: What is 25% of 72 feet? Subtract this number from 72 feet. This number will be the lower limit. Add 25% of 72 feet to 72 feet. This number will be the upper limit. Any estimate between these two numbers will be counted satisfactory.

9. In judging the height of this tree another scout said 92 feet. Was his estimate counted satisfactory?

10. On his test with weight, Jack estimated the weight of an iron bar to be 25 pounds. The weight was 28.2 pounds. Was Jack within the 25% limit? What are the lowest and the highest estimates that will be accepted in this test?

11. Before Jack took his test on estimating distances, he and three other boys practiced estimating the distance between two trees. (The measured distance was 420 yards.)

Jack's estimate was 20% above the true distance							
Jim's	"	"	15% below	"	"	"	
Herb's	"	"	10%	"	"	"	"
Bill's	"	"	40% above	"	"	"	

What was each boy's estimate?

Suggestion: After finding 20% of 420 yards, add this number to 420 yards. In finding Jim's estimate, will you add or subtract?

12. On the test the boys were asked to estimate the distance to a large oak tree. Jack's estimate was 25 feet more than the true distance, which was 250 feet. What per cent more than the true distance was Jack's estimate?

Think: 25 feet is what per cent of 250.

13. On the same test Jim's estimate was 260 feet, Herb's 200 feet, and Bill's 255 feet. What per cent over or under the true distance did each boy estimate?

PRACTICE WITH PER CENTS

1. Express the following as per cents:

.5 .27 1.3 2.65 $.12\frac{1}{2}$ .379 .09

2. Express the following as decimals:

20% 15% 6% 120% 219% $37\frac{1}{2}\%$ 8.5%

3. Express the following as common fractions:

50% 25% 10% $12\frac{1}{2}\%$ 50% 75% 40%

4. Find the following:

6% of 125	$37\frac{1}{2}\%$ of 80	120% of 100
8% of 429	50% of 120	200% of 375

5. Find the missing numbers below:

40 = —% of 400	80 = —% of 40
16 = —% of 1,600	\$6.75 = —% of \$10.00

PRACTICE TESTS IN THE FUNDAMENTALS

You should be able to find the answers to each set of examples in the time allowed and check your work.

Addition Test (8 minutes, not including copying)

1.	**2.**	**3.**	**4.**	**5.**	**6.**
487	875	312	391	564	891
509	585	497	773	349	111
260	172	485	539	643	982
981	868	926	797	366	523
532	530	479	894	899	227
429	469	839	619	548	624

Subtraction Test (4 minutes, not including copying)

1.	**3.**	**5.**	**7.**	**9.**	**11.**
7,115	6,709	9,417	8,000	7,809	6,343
3,460	4,871	7,239	6,895	5,813	1,254

2.	**4.**	**6.**	**8.**	**10.**	**12.**
7,618	6,000	5,675	4,684	5,805	4,048
6,127	3,562	3,677	4,675	1,905	1,090

Multiplication Test (8 minutes, not including copying)

1.	**3.**	**5.**	**7.**	**9.**	**11.**
357	319	731	941	385	274
46	85	39	64	27	58

2.	**4.**	**6.**	**8.**	**10.**	**12.**
269	916	268	956	584	742
93	72	204	580	903	270

Division Test (8 minutes, not including copying)

1. $74\overline{)29{,}230}$	**3.** $28\overline{)7{,}532}$	**5.** $93\overline{)14{,}647}$	**7.** $56\overline{)41{,}260}$
2. $65\overline{)18{,}265}$	**4.** $47\overline{)33{,}088}$	**6.** $39\overline{)10{,}452}$	**8.** $87\overline{)52{,}026}$

Use these tests for special practice from time to time.

PRACTICE TESTS IN FRACTIONS

You should be able to find the answers to the examples in each of the following sets in less than 10 minutes.

Addition Practice Test III

1. $\begin{array}{r}\frac{1}{2}\\ \frac{1}{2}\\ \hline\end{array}$	3. $\begin{array}{r}5\\ \frac{1}{4}\\ \hline\end{array}$	5. $\begin{array}{r}3\frac{1}{2}\\ 8\\ \hline\end{array}$	7. $\begin{array}{r}2\frac{1}{3}\\ 7\frac{2}{3}\\ \hline\end{array}$	9. $\begin{array}{r}\frac{3}{4}\\ \frac{1}{6}\\ \frac{1}{8}\\ \hline\end{array}$	11. $\begin{array}{r}\frac{2}{3}\\ \frac{4}{5}\\ \frac{7}{10}\\ \hline\end{array}$
2. $\begin{array}{r}\frac{1}{2}\\ \frac{1}{4}\\ \hline\end{array}$	4. $\begin{array}{r}\frac{1}{3}\\ \frac{5}{6}\\ \hline\end{array}$	6. $\begin{array}{r}1\frac{1}{4}\\ 3\frac{7}{12}\\ \hline\end{array}$	8. $\begin{array}{r}2\frac{2}{3}\\ 7\frac{5}{6}\\ \hline\end{array}$	10. $\begin{array}{r}6\frac{2}{3}\\ 4\frac{3}{4}\\ \hline\end{array}$	12. $\begin{array}{r}\frac{5}{12}\\ 1\frac{1}{3}\\ \hline\end{array}$

Subtraction Practice Test III

1. $\begin{array}{r}4\frac{4}{5}\\ \frac{1}{5}\\ \hline\end{array}$	3. $\begin{array}{r}7\frac{1}{8}\\ 7\\ \hline\end{array}$	5. $9 - \frac{1}{2} =$	7. $\begin{array}{r}6\\ 5\frac{2}{3}\\ \hline\end{array}$	9. $\begin{array}{r}4\frac{5}{6}\\ \frac{3}{8}\\ \hline\end{array}$	11. $\begin{array}{r}3\frac{5}{6}\\ 2\frac{3}{4}\\ \hline\end{array}$
2. $\begin{array}{r}10\frac{1}{3}\\ 3\frac{2}{3}\\ \hline\end{array}$	4. $\begin{array}{r}\frac{1}{2}\\ \frac{1}{6}\\ \hline\end{array}$	6. $\begin{array}{r}7\frac{1}{2}\\ 4\frac{2}{4}\\ \hline\end{array}$	8. $\begin{array}{r}3\frac{1}{4}\\ \frac{11}{12}\\ \hline\end{array}$	10. $\begin{array}{r}4\frac{1}{4}\\ \frac{5}{6}\\ \hline\end{array}$	12. $\begin{array}{r}7\frac{1}{2}\\ 7\frac{1}{3}\\ \hline\end{array}$

Multiplication Practice Test III

1. $\frac{2}{5} \times 2 =$	5. $3 \times \frac{1}{3} =$	9. $\frac{1}{4}$ of $\frac{1}{6} =$
2. $\frac{5}{8} \times \frac{16}{25} \times \frac{1}{2} =$	6. $2 \times 4\frac{1}{5} =$	10. $3\frac{1}{6} \times 4 =$
3. $\frac{1}{2}$ of $1\frac{1}{5} =$	7. $3\frac{1}{3} \times \frac{2}{9} =$	11. $3\frac{2}{7} \times 2\frac{2}{3} =$
4. $\begin{array}{r}18\\ 15\frac{3}{4}\\ \hline\end{array}$	8. $\begin{array}{r}17\frac{1}{6}\\ 5\\ \hline\end{array}$	12. $3\frac{1}{5} \times \frac{3}{8} \times \frac{8}{9} =$

Division Practice Test III

1. $12 \div \frac{4}{5} =$	5. $\frac{1}{9} \div \frac{1}{3} =$	9. $1\frac{1}{4} \div \frac{1}{3} =$
2. $9 \div 8 =$	6. $\frac{4}{5} \div 6 =$	10. $5\frac{2}{3} \div 5 =$
3. $\frac{3}{8} \div 1\frac{2}{3} =$	7. $2 \div 2\frac{1}{2} =$	11. $5 \div 2\frac{1}{2} =$
4. $2\frac{3}{8} \div 2\frac{3}{8} =$	8. $1\frac{1}{4} \div 3 =$	12. $3\frac{1}{3} \div 6\frac{2}{3} =$

Practice these sets of examples until you can do them all correctly in the time allowed.

PRACTICE TEST IN DECIMALS III

You should be able to find the answers to the following examples in less than 10 minutes.

1. Express as decimals: $\frac{3}{4}$, $\frac{1}{3}$, $\frac{5}{6}$, $\frac{17}{20}$, $\frac{49}{50}$.
2. Express as common fractions: .07, .5, .675, $.33\frac{1}{3}$.
3. Find the sum of the following: 4.62, 75, .125, and .97.
4. Subtract: (*a*) .275 from .9; (*b*) 4.7 from 78.53.
5. Multiply (*a*) $.6 \times 20$; (*b*) $8.04 \times .03$; (*c*) 200×8.4.
6. Divide: (*a*) $3\overline{)7.47}$; (*b*) $.3\overline{)18.63}$; (*c*) $.33\overline{)87.}$

DIAGNOSTIC TEST NO. IV

If you have difficulty with any of the examples, practice others similar to them:

1. $1\frac{7}{8} \times 9\frac{5}{6} \times 2\frac{3}{4} =$ 2. $16\frac{1}{8} - \frac{3}{4} =$
3. Multiply $1\frac{7}{8}$ by $3\frac{1}{5}$. 4. Divide $16\frac{2}{3}$ by 5.
5. Find the sum of 7.25, 1.375, 20, and .003.
6. Subtract 12.263 from 125.74.
7. Find the product of 2.56 and 1.93.
8. Divide 3967.5 by .075.
9. Express $\frac{7}{8}$ as a decimal and as a per cent.
10. 12 = ? of 60. Express as a fraction and as a per cent.
11. Express the following as decimals:
    30% 5% 125% 6% 15% 40%
12. Express as per cents.
    .26 .13 .1 .08 1.116 .6
13. Find 8% of $2.50; $175; $48.00.
14. What per cent of 200 is 60? 40? 8? 100?
15. 15% of $1.75 = ? 17. 30 = — % of 40
16. 125% of $200 = ? 18. 60 = — % of 50

PROBLEM SCALE IV

1. Jack had a box that weighed 12 pounds when empty. After he filled it with potatoes, the box weighed 72 pounds. What did the potatoes in the box weigh?

Standards		
Excellent......	9 or 10	correct
Good..........	7 or 8	correct
Fair...........	5 or 6	correct
Unsatisfactory.	0 to 4	correct

2. Helen has \$5. Mary has \$2.25. How much more than Mary has Helen?

3. An automobile travels 14.5 miles for each gallon of gasoline used. How many miles does it travel if 48 gallons are used?

4. Harry's father travels in his automobile about 30 miles an hour. How long does it take him to go 45 miles?

5. Mrs. Smith bought a rug 12.3 feet by 10.5 feet. How many square feet is the area of the rug?

6. One month the Smith family used 16.2 K. W. H. of electricity. The cost of the electricity was 11.5 cents a K. W. H. Find the cost of the electricity.

7. If $\frac{3}{4}$ yard of bunting is needed for a school pennant, how many pennants can be made from $7\frac{1}{2}$ yards of bunting?

8. Mr. Jackson raised 59.4 bushels of potatoes on a field that contained 2.25 acres. Find the average number of bushels of potatoes an acre.

9. One morning Harry dug $7\frac{1}{2}$ bushels of potatoes. At noon he sold $3\frac{1}{4}$ bushels to a neighbor. In the afternoon he dug $4\frac{1}{2}$ bushels. How many bushels of potatoes did he then have?

10. The average number of bushels of wheat an acre in the United States is 14.5. On a 10-acre field, Mr. Smith raised 136 bushels of wheat. How much less than the average an acre was this?

CHAPTER V

SOME USES OF MEASUREMENTS

Miss Andrews asked the members of her arithmetic class to tell how they made use of different kinds of measurements.

1. Harry said, "I measured my young brother's height. He is 3 feet, $6\frac{1}{2}$ inches tall." How many inches is that?

2. Mary said, "I measured the distance around a handkerchief to find the length of lace needed to make a border." What is an easy way to find the distance around a square?

3. Kate's father hauled a load of wheat that weighed 1,800 pounds. Kate said that this load was equal to 30 bushels. Was Kate correct? (60 lb. wheat = 1 bu.)

4. Jane told about an automobile trip of 120.6 miles. Eight and one-half gallons of gasoline were used. How many miles was that to the gallon?

5. Arthur said, "My father's orchard is 165 feet by 330 feet." How many acres does it contain? (1 A. = 43,560 sq. ft.)

6. Jean said, "I rode on my bicycle to the park, a distance of $4\frac{1}{2}$ miles. I left school at 3:15 P.M. and reached the park at 3:45 P.M." At this rate, how many miles did she ride in an hour?

7. Howard told the class that his father had drawn a plan of a garage to the scale of 1 inch to 4 feet. What did Howard mean?

8. Alice said, "We have a thermometer on our gas oven for measuring the temperature of the oven." Explain.

WHAT MUST YOU KNOW?

In each of the following problems there is something which you must know before you can answer the problem. Tell what you must know in each problem and then solve it.

1. How many ounces does a can of fruit marked "1 lb. 4 oz." weigh?

2. The greatest speed at which an automobile has ever traveled is about 207 miles an hour. How many miles is this a minute?

3. Harry's brother, Jack, won the 880-yard run at the college track meet. What fraction of a mile is 880 yards?

4. The children collected 12 pecks of potatoes for the Thanksgiving boxes. How many bushels was this?

5. Mr. Smith owns a farm that is the shape of a square. It is 80 rods on a side. Is the distance around the farm more than a mile?

6. Alice was 4 feet $8\frac{1}{2}$ inches tall. How many inches shorter than Henry was she if Henry was $60\frac{1}{2}$ inches tall?

7. Mrs. Andrews wished to buy linoleum for the floor of the kitchen. The kitchen was 12 feet by 15 feet. Find the cost of linoleum at $1.20 a square yard.

8. Mr. Jackson hauled a load of wheat, weighing 1,800 pounds, to market. How many bushels were there in the load?

9. A gallon of water weighs about $8\frac{1}{3}$ pounds. Find the weight of a pint.

10. Harry had $\frac{1}{2}$ bushel of tomatoes to sell. He put the tomatoes into boxes, each of which held about 4 quarts. How many boxes did he fill?

11. How much more or less than an acre is a farm 100 rods long and 60 rods wide?

ADDING DENOMINATE NUMBERS

Numbers like 10 quarts, 3 ounces, and 10 miles, are called *denominate numbers* because they are named. Denominate numbers can be added, subtracted, multiplied, and divided.

1. Mary practiced her piano lesson for 1 hour 15 minutes in the morning and 1 hour 25 minutes in the afternoon. How long did she practice in all? In this problem you must add 1 hour 15 minutes and 1 hour 25 minutes. Such numbers are called *compound denominate numbers.*

1 hr. 15 min. **1 hr. 25 min.** **2 hr. 40 min.**	Write minutes under minutes and hours under hours as shown in the example. Add the minutes. Add the hours. Mary practiced 2 hr. 40 min.

2. Harry had a two-section fishing rod which was 3 feet $6\frac{1}{2}$ inches long. He bought another section 1 foot 8 inches long. How long was his fishing rod then?

3 ft. $6\frac{1}{2}$ in. **1 ft. 8 in.** **4 ft. $14\frac{1}{2}$ in. =** **5 ft. $2\frac{1}{2}$ in.**	You can see that the sum of the inches is $14\frac{1}{2}$. This equals 1 ft. $2\frac{1}{2}$ in. Therefore 4 ft. $14\frac{1}{2}$ in. is written as 5 ft. $2\frac{1}{2}$ in.

Add the following denominate numbers:

3. 2 hr. 45 min. 3 hr. 10 min.	**6.** 3 ft. 8 in. 2 ft. $3\frac{1}{2}$ in.	**9.** 6 yd. $2\frac{1}{2}$ ft. 2 yd. $2\frac{1}{4}$ ft.
4. 2 lb. 10 oz. 4 lb. 0 oz.	**7.** 2 gal. 3 qt. 3 gal. $2\frac{1}{2}$ qt.	**10.** 1 qt. $1\frac{1}{2}$ pt. 2 qt. $\frac{1}{2}$ pt.
5. 3 ft. 9 in. 2 ft. 6 in.	**8.** 1 T. 500 lb. 2 T. 1,500 lb.	**11.** 4 mi. 220 yd. 2 mi. 1,500 yd.

SUBTRACTING DENOMINATE NUMBERS

1. John jumped over a parallel bar set at 4 feet $4\frac{1}{2}$ inches. The school record was 5 feet 3 inches. How much higher must John jump to reach the school record?

5 ft. 3 in.	You cannot subtract $4\frac{1}{2}$ in. from 3 in. Change
4 ft. 15 in.	5 ft. 3 in. to 4 ft. 15 in. First subtract the inches.
4 ft. $4\frac{1}{2}$ in.	15 in. $-$ $4\frac{1}{2}$ in. $=$ $10\frac{1}{2}$ in. There will be no feet.
$10\frac{1}{2}$ in.	John must jump $10\frac{1}{2}$ in. higher.

2. Mary can jump 5 feet 2 inches. How much higher than John can Mary jump?

3. A classroom was 21 feet 6 inches in length, and 14 feet 8 inches in width. How much greater than its width was its length?

4. In a certain week Mary practiced her piano lessons for 6 hours and 15 minutes. Grace practiced 4 hours and 35 minutes. How much longer than Grace did Mary practice?

Subtract the following:

5. 12 bu. 11 qt. 4 bu. 18 qt.	**7.** 4 lb. 12 oz. 1 lb. 1 oz.	**9.** 8 yd. $4\frac{1}{4}$ in. 4 yd. 9 in.
6. 25 ft. 5 in. 10 ft. 7 in.	**8.** 5 hr. 18 min. 3 hr. 24 min.	**10.** 7 lb. 2 lb. 7 oz.

11. Mary had a piece of ribbon 3 yards 8 inches in length. She cut off a piece 18 inches long. How long was the piece of ribbon that was left?

***12.** Henry had gathered 1 bushel 4 quarts of butternuts. He gave a peck of them to his chum. How many quarts of butternuts did he then have?

MULTIPLICATION OF DENOMINATE NUMBERS

1. Mary's mother measured the windows for curtains. She found that for one room she would need 8 strips, each 8 feet 7 inches in length. How much cloth must she buy?

8 ft. 7 in. **8** **4 8** **64** **68 ft. 8 in. of cloth are needed.**	8×7 in. = 56 in. = 4 ft. 8 in. Write 4 ft. 8 in. as shown in the example. Multiply 8 ft. by 8. Write 64 as shown in the example. Add to get the amount of cloth needed.

2. In another room she needed 7 strips, each 8 feet 9 inches in length. How much cloth was needed for this room?

3. Find the weight of a box of 24 cans of peaches if each can weighs 1 pound 3 ounces. How do you change ounces to pounds?

4. An automobile travels a mile in 1 minute 35 seconds. At that rate, how long would it take to go 20 miles?

Find the products:

5. 8 ft. $5\frac{1}{2}$ in.
7

6. 2 hr. 14 min.
6

7. 8 lb. 15 oz.
9

8. 1 qt. $\frac{1}{2}$ pt.
9

9. 2 gal. $2\frac{1}{2}$ qt.
5

10. 3 bu. $2\frac{1}{2}$ pk.
4

11. 1 lb. $8\frac{1}{2}$ oz.
6

12. 5 ft. 7 in.
6

13. 3 yd. 2 ft.
3

14. Find the total length of 6 boards each 10 feet $4\frac{1}{2}$ inches long.

ALBERT'S PRIZE POTATO PATCH

1. Albert raised potatoes as his boys' club project. Here is the record of his expenses and his time:

4 hr. plowing and harrowing at \$.60 an hr.	?
2 bu. of seed at \$.90 a bu.	?
$2\frac{1}{2}$ hr. planting at \$.25 an hr.	?
$3\frac{1}{2}$ hr. cultivating at \$.25 an hr.	?
$8\frac{1}{4}$ hr. digging at \$.25 an hr.	?
Fertilizer	\$2.00
Total cost	?

2. He raised 42 bushels on his patch. He sold 40 bushels of selected potatoes at \$1.20 a bushel, and the remainder at \$.50 a bushel. What did he receive for his potatoes?

3. Is it correct to count wages for himself as part of his expenses?

4. What was his profit?

5. How much time in all did he work in his potato patch?

***6.** His potato patch was 15 feet wide and 363 feet long. What fraction of an acre is this?

***7.** What would be the yield an acre at this rate?

8. Albert's chum, Arthur, raised 84 bushels of potatoes on a $\frac{7}{8}$-acre field. How many bushels did he raise an acre at this rate?

9. Arthur received \$105.00 for the 84 bushels of potatoes he raised. What did he receive a bushel? How much more than Albert received did Arthur receive a bushel?

FINDING COSTS

1. A piece of beefsteak purchased by Harry's mother weighed 1 pound 4 ounces. The price was 40¢ a pound. The butcher charged her 50¢ for the meat. To make sure this was the correct amount, she said, "One pound 4 ounces is $1\frac{1}{4}$ pound, since 4 ounces is $\frac{1}{4}$ pound; $1\frac{1}{4} \times \$.40 = \$.50$."

2. Find the cost of 1 pound 6 ounces of sirloin steak at 48¢ a pound.

Think: 1 pound 6 ounces = $1\frac{3}{8}$ pound.

Find the cost of the following:

3. 4 lb. 8 oz. of butter @ \$.48 lb.
4. 2 lb. 12 oz. of meat @ \$.44 lb.
5. 2 bu. 2 pk. potatoes @ \$1.20 bu.
6. 3 gal. 1 qt. of cider @ \$.60 gal.
7. 3 yd. 27 in. of cloth @ \$.24 yd.
8. 4 bu. 12 qt. of corn @ .84 bu.
9. 2 lb. 6 oz. pork chops @ \$.40 lb.
10. 14 oz. cheese @ \$.48 lb.
11. 5 lb. 3 oz. beefsteak @ \$.48 lb.
12. 9 oranges @ \$.56 doz.
13. 18 doughnuts @ \$.20 doz.
14. 21 in. ribbon @ \$.40 yd.
15. 7 qt. cider @ \$.30 gal.

FINDING AREAS

1. Find the area of a room 10 feet 6 inches long and 8 feet 4 inches wide.

Hint: change inches to feet and then multiply.

Find the areas of these rectangles:

2. 10′ 6″ by 4′ 6″.
3. 8′ 7″ by 6′ 3″.
4. 4 yd. 2 ft. by 18 in.
5. 5 yd. 1 ft. by 1 yd. 2 ft.

DIVISION OF DENOMINATE NUMBERS

1. A railroad train traveled 5 miles in 7 minutes 10 seconds. What was the average time a mile?

1 min. 26 sec. **5)7 min. 10 sec.**	7 min. ÷ 5 = 1 min., and 2 min. over. 2 min. = 120 sec. Add: 120 + 10 = 130 sec. 130 ÷ 5 = 26.

2. Is this method easier than changing 7 minutes 10 seconds to minutes and dividing by 5? Try it.

3. A farmer used 8 bushels 3 pecks of seed in planting a 3-acre field. How much was this an acre?

Divide each of the following:

4. 8 ft. 5 in. by 3.

5. 2 ft. 7 in. by 2.

6. 9 hr. 25 min. by 5.

7. 8 gal. 2 qt. by 6.

8. 6 t. 8 cwt. by 5.

9. 4 lb. 9 oz. by 6.

10. A baker used 7 pounds 8 ounces of flour to make 10 loaves of bread. How much flour a loaf was this?

11. Harry had three apple trees. From the first he picked 3 bushels 2 pecks, from the second 3 bushels 3 pecks, and from the third 4 bushels 3 pecks. What was the average yield a tree?

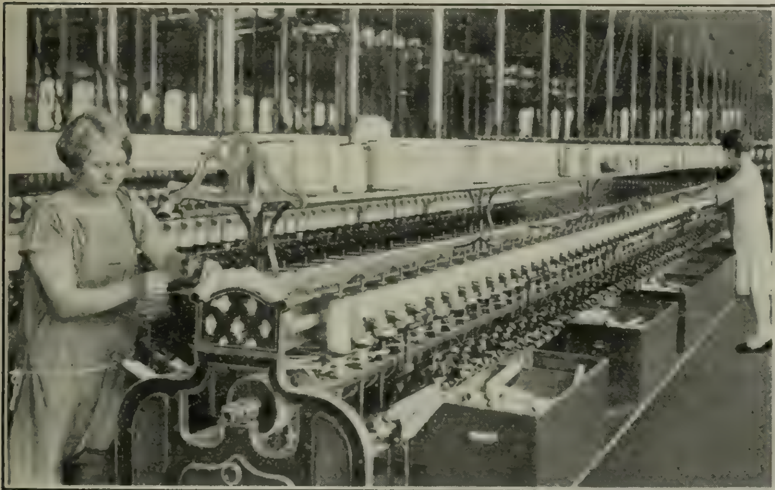
12. Below are given the heights of four eleven-year-old children:

Mary	**5 ft. 1½ in.**	**Kate**	**4 ft. 9 in.**
John	**4 ft. 6 in.**	**Peter**	**4 ft. 11½ in.**

What was their average height?

13. A carpenter cut a board 12 feet 6 inches long into 5 equal pieces. How long was each piece?

14. A passenger train traveled 40 miles in 1 hour 15 minutes. How many miles a minute was this?



SPINNING COTTON INTO THREAD AND CLOTH

Here are some interesting problems on manufacturing cotton into thread and cloth. When the cotton bales come to the factory, the compressed cotton in them is put through the "bale breaker," and then passed on to a machine called the "opener." One machine of this kind will open 8,000 pounds of cotton in 24 hours.

1. A bale of cotton weighs, on the average, 500 pounds. How many bales of the average weight will 8,000 pounds of cotton make?

2. How many bales will the "opener" open in 1 hour?

After being mixed, carded, and combed, the cotton is spun into thread. The size of thread which you see upon spools depends upon the number of yards required to make one pound. In the United States, the unit is 840 yards to the pound; that is, No. 1 cotton thread has 840 yards to the pound; No. 2 has 2 times 840 yards; No. 3 has 3 times 840 yards, and so on.

3. How many yards to the pound are there in each of the following sizes of cotton thread: No. 10? No. 36? No. 40? No. 50? No. 80?

4. Which will weigh more, 200 yards of No. 40 or 200 yards of No. 80?

5. Sea Island cotton will make a size as fine as No. 400. How many yards of this size of thread will make one pound?

6. A spool of No. 36 cotton thread has 200 yards upon it. How many such spools of thread will make one pound?

7. A pound of cotton is spun into No. 40 thread. The thread is then wound upon spools, 200 yards to each spool. How many spools are made?

8. Get some spools of thread. Notice the numbers of the thread, and also the number of yards on each. Find how many such spools can be made from 1 pound of cotton.

After the cotton is spun, the thread is woven into cloth. Any of the following may be produced from one pound of cotton: $1\frac{1}{2}$ yards of denim; 4 yards of sheeting; 7 yards of calico; 25 handkerchiefs.

9. How many yards of denim can be made from 9 pounds of cotton?

10. How many pounds of cotton are required to produce 84 yards of sheeting?

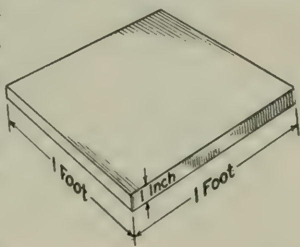
11. How many handkerchiefs can be made from a bale of cotton of the average weight? (See problem **1**.)

12. How many more yards of calico than of sheeting can be produced from 20 pounds of cotton?

HOW LUMBER IS MEASURED

John and Fred needed book shelves for their room. Their brother, Ben, drew a plan for them, helped to find how much lumber they needed, and showed them how to find its cost.

1. Lumber is usually measured by the *board foot*. A board foot of lumber is 1 foot long, 12 inches (1 foot) wide, and 1 inch thick. A board of ordinary lumber less than an inch thick is measured as if it were one inch thick.



To find the number of board feet in a piece of lumber, multiply the length in feet by the width in inches by the thickness in inches, and divide the result by 12.

2. Find the number of board feet in a board 8 feet long, 10 inches wide, and 2 inches thick (usually written 2″ x 10″ x 8′); in two boards of these dimensions.

Find the number of board feet in:

3. 3 boards, 3″ x 12″ x 9′

4. 6 boards, 2″ x 4″ x 12′

5. 7 boards, 1″ x 8″ x 10′

6. 2 boards, $\frac{7}{8}$″ x 6″ x 5′

HOW LUMBER IS SOLD

Lumber is usually sold at so much a 1,000, or M, feet. If a carpenter bought 200 feet of lumber at $18 a M, he would find the cost as follows:

$$\frac{\cancel{200} \times \$18}{\underset{5}{\cancel{1000}}} = \frac{18}{5} = \$3.60$$

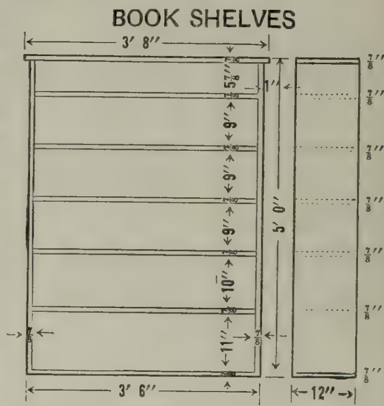
1. Find the cost of 400 feet of lumber at $20 a M.

2. Find the cost of 458 feet at $18.50 a M.

3. Find the cost of 3 boards, 2″ x 8″ x 10′, at $16 a M.

4. Find the cost of 8 boards, $\frac{3}{4}$″ x 4″ x 12′, at $24.50 a M.

THE COST OF LUMBER FOR THE BOOK SHELVES



1. Study the plan of the book shelves. The boys need for end pieces 2 boards, 5 feet long, 12 inches wide, and $\frac{7}{8}$ inch thick. How many board feet are there in these end pieces?

2. How many shelves are there? (Count the bottom board.) How long is each? how wide? how thick? How many board feet are there in the shelves?

3. How long is the top board? how wide? how thick? How many board feet are there in the top board?

4. The boys decided to board up the bookshelves at the back. For this they used boards 10 inches wide, $\frac{7}{8}$ inch thick. How many boards will they need?

5. How many board feet will there be in these boards?

6. How many board feet of lumber did the boys have to buy for their shelves?

7. What did the lumber cost at $15 a M.

Find the cost of the following lumber:

8. 3 boards, $\frac{1}{2}''$ x 8″ x 12′ at $18 a M.

9. 7 boards, 2″ x 4″ x 8′ at $20 a M.

10. 20 planks, 2″ x 12″ x 12′ at $17.50 a M.

11. 16 planks, 4″ x 10″ x 10′ at $18.50 a M.

12. 40 boards, 2″ x 8″ x 12′ at $42 a M.

13. 75 boards, 1″ x 6″ x 14′ at $32 a M.

14. 80 boards, 1″ x 12″ x 10′ at $25 a M.

ACTING AS TRAFFIC POLICE

Arthur attends a large school in a city. A sign near the school said, "*Public School, Speed Limit 12 Miles an Hour.*" Arthur's class was asked to find whether or not cars passing the school were obeying the law. These are some of the problems Arthur's class solved:

1. If a car is traveling at the rate of 12 miles an hour, how many minutes will it take to go one mile?

2. How many seconds will it take to go a mile?

3. Arthur measured the street in front of the school grounds, and found that it was 660 feet from one end to the other. What part of a mile is this?

4. How many seconds will a car take to go this distance traveling at the rate of 12 miles an hour?

5. Arthur got a stop watch and timed cars going past the school. One took 25 seconds to go from one end of the grounds to the other. Was the driver of this car breaking the law?

6. Was a driver who took 40 seconds to go past the school grounds going faster than he should?

***7.** At what rate in miles an hour were the cars mentioned in problems **5** and **6** going when they passed the school grounds?

A SPEED TEST IN FRACTIONS

Practice this exercise until you can give the answers to each set correctly in less than one and one-half minutes.

Set I

	a	*b*	*c*
1.	$\frac{1}{2}$ of 20 =	$\frac{1}{4}$ of 60 =	$\frac{1}{8}$ of 30 =
2.	$\frac{2}{3}$ of 45 =	$\frac{3}{4}$ of 40 =	$\frac{5}{8}$ of 40 =
3.	$\frac{1}{2}$ of 11 =	$\frac{2}{3}$ of 10 =	$\frac{3}{4}$ of 15 =

Set II

4.	6 = ? of 12	4 = ? of 6	9 = ? of 12
5.	8 = ? of 16	8 = ? of 24	12 = ? of 16
6.	9 = ? of 27	10 = ? of 15	15 = ? of 25

Set III

7.	5 = $\frac{1}{2}$ of ?	6 = $\frac{1}{3}$ of ?	8 = $\frac{2}{3}$ of ?
8.	4 = $\frac{1}{3}$ of ?	8 = $\frac{1}{5}$ of ?	16 = $\frac{4}{5}$ of ?
9.	9 = $\frac{1}{4}$ of ?	8 = $\frac{1}{2}$ of ?	10 = $\frac{2}{3}$ of ?

Set IV

10.	$\frac{1}{4}$ of 18 =	12 = ? of 18	36 = $\frac{2}{3}$ of ?
11.	8 = ? of 10	16 = $\frac{2}{3}$ of ?	$\frac{4}{5}$ of 60 =
12.	12 = $\frac{1}{2}$ of ?	$\frac{3}{4}$ of 20 =	16 = ? of 24

Set V

13.	$\frac{1}{2}+\frac{1}{4}=$	$\frac{1}{4}+\frac{2}{3}=$	$\frac{7}{10}-\frac{2}{10}=$
14.	$\frac{1}{3}+\frac{5}{6}=$	$\frac{3}{4}+\frac{4}{5}=$	$\frac{3}{4}-\frac{1}{3}=$
15.	$\frac{7}{8}+\frac{3}{4}=$	$\frac{1}{2}+\frac{1}{10}=$	$\frac{5}{6}-\frac{2}{3}=$

PRACTICE WITH DECIMALS

Find the answers. How many of the examples can you work correctly without a pencil?

1. $.1 + .1 =$	**24.** $.004 + .072 =$
2. $.3 - .1 =$	**25.** $6.53 - .12 =$
3. $5.2 - 4 =$	**26.** $6.4 \div 8 =$
4. $.7 \times 7 =$	**27.** $.005 \times 8 =$
5. $7.2 \div .8 =$	**28.** $.07 + .06 =$
6. $4.1 \times .2 =$	**29.** $4 - .003 =$
7. $84.7 \div 7 =$	**30.** $5.36 \div .4 =$
8. $.01 + .9 =$	**31.** $9.74 - 1.2 =$
9. $6 \div .8 =$	**32.** $.468 \div 9 =$
10. $.06 \times 4 =$	**33.** $2.3 \times .04 =$
11. $.001 \div .1 =$	**34.** $5.1 + 6.02 =$
12. $.017 - .004 =$	**35.** $6.5 \div .5 =$
13. $7.735 \div .005 =$	**36.** $6.1 + 7.245 =$
14. $3.3 \times .3 =$	**37.** $7.25 \div .05 =$
15. $4.003 + 2.4 =$	**38.** $.006 \times 71 =$
16. $5.6 \times .8 =$	**39.** $15 + .17 =$
17. $.04 \times 2.5 =$	**40.** $8.127 \div 7 =$
18. $960 \div .8 =$	**41.** $3.1 - .56 =$
19. $1.4 + .7 =$	**42.** $7.3 \times .08 =$
20. $5.8 + .3 =$	**43.** $9.258 - 3.249 =$
21. $5 - 1.64 =$	**44.** $4.52 + .001 =$
22. $7.8 \times .9 =$	**45.** $75.36 - 74.05 =$
23. $.006 \div .003 =$	**46.** $8 - .75 =$

47. Express the following as common fractions:

.5 .25 .75 .125 .2 .08

48. Change the following to decimals. Carry the work to three places:

$\frac{75}{86}$ $\frac{97}{108}$ $\frac{16}{17}$ $\frac{25}{33}$ $\frac{18}{19}$ $\frac{15}{16}$

WAGONS OR MOTOR TRUCKS, WHICH?

1. Mr. Olson lived 25 miles from the railway. For years he used a wagon to take his wheat to the elevator. With a team and wagon it took him two days to make the trip, and he found his horses could make only two trips a week. How far did the team travel in the two trips?

2. His wagon held 35 bushels of wheat. How many bushels was he able to take to the elevator in a week?

3. At $1.30 a bushel, how much did he receive for all the wheat he could haul to the elevator in two trips?

4. Some years later, Mr. Olson bought a motor truck. He found he could take two truck loads of wheat to the elevator a day. How many miles would he travel in these trips in a day? in a week of six days?

5. He found the truck could take 70 bushels of wheat in a load. How many bushels could he haul to the elevator in a day? in a week of six days?

6. How much more than he could haul before in a week with his wagon could he haul in six days with his truck?

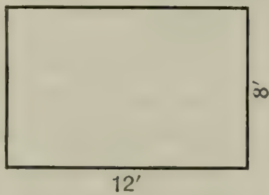
7. If he received $1.30 a bushel for the wheat, how much money would he receive for all of the wheat he could haul by truck to the elevator in one week? (See problem **5.**)

8. One year he harvested 1,470 bushels of wheat. How long would it take to haul this grain to the elevator by wagon? by truck?

9. How much less time than by team would it take to haul the 1,470 bushels of wheat by truck?

CHANGING DIMENSIONS TO LIKE UNITS

1. How many square feet are there in a floor 12 feet long and 8 feet wide?



In this case the dimensions are both given in the same units.

Notice the following problem.

2. What is the area of a floor 4 yards long and 8 feet wide?

Here the dimensions are not in the same unit, and one of them must be changed so that the unit of measure will be the same.

Change 4 yards to feet. The work would then be: $12 \times 8 = ?$ square feet, the area of the floor.

Or change 8 feet to yards. What would the work then be?

3. Find the perimeter of a farm $\frac{1}{2}$ mile long and 60 rods wide.

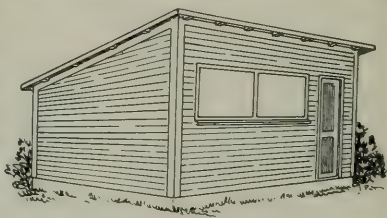
4. How many acres are there in a farm $\frac{3}{4}$ mile long and 160 rods wide?

Find the areas of the following rectangles:

	Length	Width		Length	Width
5.	25 ft.	12 yd.	**8.**	$\frac{1}{2}$ mi.	60 rd.
6.	18 yd.	40 ft.	**9.**	3 ft. 6 in.	2 ft. 4 in.
7.	100 yd.	10 rd.	**10.**	6 yd. 2 ft.	8 yd. $1\frac{1}{2}$ ft.

PAINTING A POULTRY HOUSE

Mr. Simpson's poultry house is to be painted. The door and the windows are all in the front of the building, and Mr. Simpson will paint this part himself. Jack is to put a coat of tar on the roof and one coat of paint on the two ends and the back of the poultry house. As he is to be paid by the square yard, his first problem is to measure the surface that he is to paint.



1. He first climbed to the roof. He saw at once that the surface of the roof was a rectangle. He found that it was 12 feet by 10 feet.

a. Draw a diagram of the roof to the scale of $\frac{1}{2}$ inch to 1 foot.

b. What is the area of the roof in square feet? in square yards?

2. Jack received 18¢ a square yard for putting the tar on the roof. What did he receive for this part of the job?

3. The back of the house is 12 feet by 7 feet.

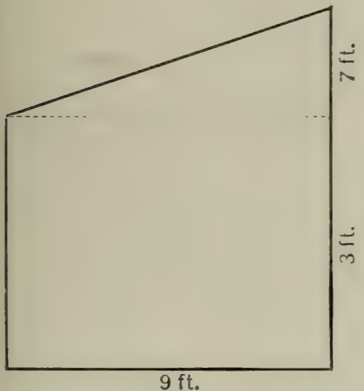
a. What is its area in square yards?

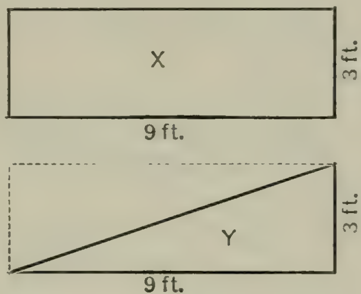
b. How much will Jack receive for painting the back of the house at 12¢ a square yard?

4. Jack drew a diagram of the ends of the chicken house like the diagram at the left on page 365. To what scale is it drawn?

5. Jack drew the dash line you see in the diagram. What shape is the surface below this line? What is its area in square feet? in square yards?

Jack did not know how to find the area of the triangle you see in the plan. His father helped him by drawing the diagram at the right:





6. What is the area of rectangle X?

7. Triangle Y is equal to the triangle in the plan of the end of the poultry house. You see that it is also equal to $\frac{1}{2}$ of the area of rectangle X. Its area must, therefore, be equal to $\frac{1}{2}$ of 9 x 3, or $13\frac{1}{2}$ square feet. Since 9 feet and 3 feet are the length and width of the rectangle, the area of the triangle is equal to $\frac{1}{2}$ of the product of the length and width of the rectangle.

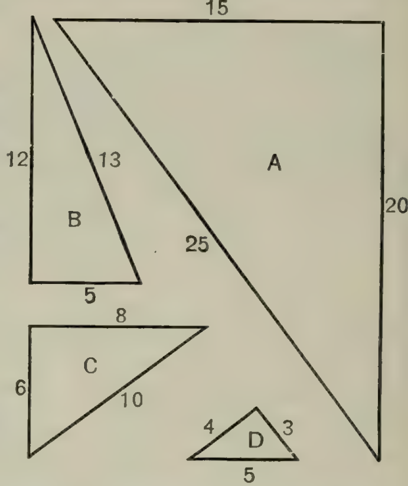
The height of a triangle is called its *altitude.* The side from which the altitude is measured is called its *base.* A triangle that is half of a rectangle is called a *right triangle.*

The area of a triangle is equal to $\frac{1}{2}$ *the product of the base by the altitude.*

8. Find how much Jack received for painting the poultry house at 12¢ a square yard.

FINDING AREAS OF RIGHT TRIANGLES

1. *A*, *B*, *C*, *D* are right triangles. The lengths of their sides are indicated. Find the base and altitude of each triangle. Then find its area.



2. Draw a right triangle with a base 7 inches and an altitude 3 inches. Find its area.

3. Draw a rectangle whose base is 5 inches and whose altitude is 4 inches. Find its area.

4. Draw a rectangle 3 inches long and 2 inches wide. What is its area? What is its perimeter?

5. Draw three right triangles. Measure their bases and altitudes and find their areas.

FINDING CUBIC CONTENTS

1. Find the number of cubic feet in a rectangular tank 8 feet by 7 feet by 11 feet.

2. Find the number of bushels that a wagon box 10 feet 6 inches long, 28 inches deep, and 42 inches wide will contain. A bushel equals about $1\frac{1}{4}$ cubic feet.

3. Find the capacity of the upper part of an ice box if the dimensions are $24\frac{1}{2}$ inches by $16\frac{1}{2}$ inches by 20 inches.

4. Find the capacity of the lower part of the ice box if the dimensions are $24\frac{1}{2}$ inches by $16\frac{1}{2}$ inches by 30 inches.

THE PROPER AMOUNT OF SPACE FOR HEALTHFUL LIVING

In schoolrooms 15 square feet of floor space a pupil and 180 cubic feet of air space a pupil are considered satisfactory.

1. In a schoolroom 23 feet wide and 32 feet long there are 40 pupils. Is there enough floor space for each pupil?

2. The height of the room is 12 feet. Is there enough air space for each pupil?

3. If the height of the room were $9\frac{1}{2}$ feet, would the number of cubic feet of air a pupil be up to the standard?

4. Find the number of square feet a pupil for your own classroom. Is it up to standard?

5. Find the number of cubic feet of air a pupil for your own classroom. Is it up to standard?

6. Find the same information for other rooms in your school.

MEASURING WOOD

1. Formerly when wood was plentiful, it was used a great deal. It was sold by the cord. A cord represents a pile of four-foot lengths, four feet high and eight feet long. How many cubic feet are there in a cord?

2. A good-sized schoolroom is 23 feet wide, 32 feet long, and 12 feet high. Would it hold 15 cords of wood?

3. How many cords would there be in a level-full truck whose capacity is 5 cubic yards?

FARM MEASURES

1. A bushel of shelled corn contains $1\frac{1}{4}$ cubic feet. How many bushels are there in a bin 6 feet long, 4 feet wide, and 2 feet 6 inches deep?

2. A bushel of potatoes contains $1\frac{1}{3}$ cubic feet. How many bushels are there in a bin 6 feet 6 inches long, 7 feet 4 inches wide, and 8 feet 3 inches deep?

3. How many gallons of water are there in a tank 6 feet 4 inches by 2 feet 6 inches by 3 feet 4 inches? A gallon = $\frac{1}{8}$ cubic foot.

4. A ton of tame hay contains 512 cubic feet. How many tons are there in a space 24 feet by 12 feet by 16 feet?

5. A ton of wild hay contains about 343 cubic feet. How many tons are there in a space 25 feet 6 inches by 18 feet 2 inches by 9 feet?

6. A cow produced, on the average, $3\frac{1}{2}$ gallons of milk a day. If a gallon weighs $8\frac{5}{8}$ pounds, how many pounds of milk does she produce a week?

7. Suppose you had a chicken yard 60 feet by 100 feet. What would it cost to fence the yard with chicken wire at $4\frac{1}{2}$¢ a foot?

8. A farmer, owning $64\frac{1}{2}$ acres, sold $15\frac{3}{4}$ acres and then bought 20 acres. How many acres did he then have?

9. Mr. Smith hauled a load of hay to town. The hay weighed 2,575 pounds. At $12 a ton what should Mr. Smith receive for the hay?

10. A dairy farmer sold to a creamery 5,624 pounds of milk, for which he was paid $1.75 a hundred pounds. What did he receive for the milk?

11. Find the cost of 90 pounds of wheat at $1.20 a bushel.

A DAIRY ACCOUNT

Many farmers send their milk to creameries to be churned into butter. The farmers are paid by the creameries according to the percentage of butterfat the milk contains. Below is an account which a creamery kept with seven of its customers. The table shows the average results of the Babcock test, which tests the percentage of butterfat in the milk.

Name	Pounds of Milk	Per Cent of Butterfat	Pounds of Butterfat	Price a Pound	Value
J. Brain.............	7,380	3.8	?	32¢	?
Wm. Casper.........	6,350	4.2	?	33¢	?
Ole Johnson.........	9,500	4.1	?	33¢	?
Henry Merten.......	6,200	3.7	?	32¢	?
J. E. Simpson........	5,150	3.9	?	32¢	?
John Veland.........	4,650	4.3	?	33¢	?
C. J. Smith..........	6,840	3.6	?	32¢	?

1. Which farmer's milk had the largest per cent of butterfat?

2. How much larger was the test for butterfat for J. Brain's milk than for C. J. Smith's milk?

Think: $3.8\% - 3.6\% = ?\ \%$

3. What was the average per cent of butterfat for the seven accounts?

4. How many pounds of butterfat did Mr. Brain's milk yield?

Think: 3.8% of 7,380 lb. $= .038 \times 7{,}380 = ?$ lb.

5. Find the pounds of butterfat sold by each of the men.

6. Each man was paid the prices given in the table for butterfat. Find how much each man should receive from the creamery.

THE HOMING PIGEON

1. It takes the Capital Limited on the B. & O. Railroad 3 hours 29 minutes to run from Cumberland to Washington. A homing pigeon flew this distance in 1 hour 54 minutes. How much longer than the homing pigeon did it take the train?

2. A homing pigeon was taken by automobile from its home loft to a place 180 miles away. It took the automobile 5 hours 56 minutes to reach the place. The pigeon was immediately released, and flew back to its home in 4 hours 48 minutes. How long was the pigeon away from its home on this trip? What was the pigeon's speed in miles an hour? in yards a minute?

3. A good average speed for a homing pigeon is 1,200 yards a minute. How many yards is this an hour? how many miles an hour?

4. How does the speed that you found for the homing pigeon in problem **2** compare with the average speed?

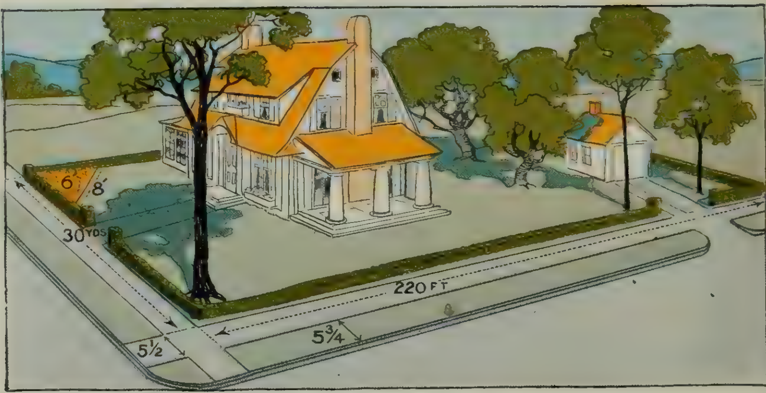
*5. During the World War "Big Tom," a homing pigeon, was released at 2:35 o'clock one afternoon. Though wounded by a bullet from a machine gun, it delivered its important message at a village 24 miles away at exactly 4:00 P.M. What was "Big Tom's" speed in miles an hour?

*6. "Bill of Atlanta," another homing pigeon, won first place in a 500-mile race. How long do you think it took him? If he made as good speed as the pigeon in problem 2, how long did it take him? If he could fly as fast as "Big Tom," how long did it take him to fly 500 miles?

USES OF UNITS OF MEASUREMENT

What unit of measurement would you use to express each of the following:

1. The length of a city block?
2. Your height?
3. The capacity of a pail?
4. The weight of the coal in the earth?
5. The amount of cream in a small bottle?
6. The area of the kitchen floor?
7. The weight of a small package of spice?
8. The volume of a small cube?
9. The amount of wheat in a car?
10. The distance from Chicago to Detroit?
11. The area of the state of Texas?
12. The area of a farm?
13. The amount of water in a big reservoir?
14. The length of time it takes a sprinter to run 100 yards?
15. The amount of gasoline used on a trip?
16. The greatest depth of the ocean?
17. The amount of corn produced on an acre?
18. The volume of a large box?



MR. BROWN'S HOME

1. This is the picture of the home which Alfred's father, Mr. Brown, has just purchased for \$15,000. He paid 25% of this sum in cash. How much cash did Mr. Brown pay down when he purchased the property?

2. How much does he owe on the property? What per cent of the entire cost is this?

3. If Mr. Brown pays \$2,250 on this debt every year, in how many years will he pay off the debt on his home?

4. The lot is 220 feet along the street and 30 yards deep. What part of an acre is it? (43,560 sq. ft. = 1 acre.)

5. Lots in that part of the city are worth \$15 a front foot. What is Mr. Brown's lot worth?

6. What part of the cost of the whole property is the value of the lot? Reduce your answer to a decimal.

7. The sidewalk on each side of the street in front of this home is $5\frac{1}{2}$ feet wide. It is $5\frac{3}{4}$ feet from the edge of the sidewalk to the curb, and $57\frac{1}{4}$ feet from curb to curb. What is the entire width of the street in front of Mr. Brown's home?

8. Alfred laid out the triangular pansy bed which you see at the left of the house. It is a right triangle in shape. The base is 8 feet and the altitude 6 feet. How many square feet are in the pansy bed?

9. Mr. Brown bought the following pieces of lumber to repair the garage:

8 boards 1″ x 8″ x 10′ at \$28 a M.
10 pieces of lumber 2″ x 4″ x 10′ at \$32 a M.

What was the total cost of the lumber?

10. Mr. Brown had two apple trees. From one he picked 2 bushels 3 pecks, and from the other he picked 5 bushels 1 peck. He sold the apples for \$2 a bushel. What did he receive for them?

PRACTICE TESTS IN FRACTIONS

You should be able to find the answers to the examples in each of the following sets in less than 10 minutes.

Addition Practice Test IV

1. $\frac{1}{6}$ $\frac{1}{6}$	**3.** 5 $2\frac{7}{8}$	**5.** $\frac{1}{8}$ $2\frac{1}{8}$	**7.** $\frac{1}{3}$ $\frac{1}{6}$	**9.** $8\frac{2}{3}$ $5\frac{3}{4}$	**11.** $\frac{2}{3}$ $\frac{1}{4}$ $4\frac{1}{12}$
2. $2\frac{1}{3}$ $3\frac{7}{12}$	**4.** $9\frac{2}{3}$ $7\frac{5}{6}$	**6.** $\frac{1}{4}$ $\frac{5}{6}$ $\frac{1}{8}$	**8.** $8\frac{1}{5}$ $7\frac{1}{6}$	**10.** $\frac{2}{5}$ $1\frac{2}{3}$	**12.** $2\frac{17}{24}$ $4\frac{5}{6}$ $3\frac{5}{8}$

Subtraction Practice Test IV

1. $4\frac{2}{3}$ $\frac{2}{3}$	**3.** $4\frac{3}{5}$ $2\frac{1}{5}$	**5.** 1 $\frac{1}{4}$	**7.** $2\frac{1}{8}$ $\frac{1}{8}$	**9.** $1\frac{1}{8}$ $\frac{1}{3}$	**11.** $8\frac{1}{8}$ $1\frac{1}{2}$
2. $9\frac{3}{5}$ $8\frac{4}{5}$	**4.** $3\frac{3}{4}$ $\frac{1}{2}$	**6.** $3\frac{5}{6}$ $1\frac{2}{3}$	**8.** $\frac{1}{3}$ $\frac{1}{4}$	**10.** $3\frac{1}{4}$ $1\frac{2}{3}$	**12.** $2\frac{1}{6}$ $\frac{2}{3}$

Multiplication Practice Test IV

1. $\frac{2}{3} \times 16 =$

2. $6 \times 2\frac{1}{3} =$

3. $\frac{5}{8} \times 6\frac{2}{5} =$

4. $4\frac{3}{8} \times 2\frac{6}{7} \times 1\frac{4}{5} =$

5. $4 \times \frac{1}{2} =$

6. $6 \times 4\frac{3}{8} \times 2\frac{4}{5} =$

7. $3\frac{1}{8} \times \frac{1}{8} =$

8. $\begin{array}{r} 25\frac{1}{2} \\ \underline{27} \end{array}$

9. $\frac{1}{4} \times \frac{8}{9} =$

10. $3\frac{2}{3} \times 8 =$

11. $2\frac{1}{4} \times 2\frac{1}{4} =$

12. $\begin{array}{r} 18 \\ \underline{4\frac{3}{4}} \end{array}$

Division Practice Test IV

1. $14 \div \frac{4}{5} =$

2. $\frac{1}{5} \div 5 =$

3. $\frac{5}{12} \div 1\frac{5}{6} =$

4. $3\frac{1}{3} \div 1\frac{3}{4} =$

5. $\frac{3}{8} \div \frac{3}{8} =$

6. $10 \div 6 =$

7. $3 \div 4\frac{1}{2} =$

8. $6 \div 3\frac{1}{2} =$

9. $3\frac{1}{2} \div \frac{1}{2} =$

10. $5\frac{3}{5} \div 2 =$

11. $12 \div 6\frac{3}{5} =$

12. $1\frac{1}{2} \div 4\frac{1}{2} =$

Practice these sets of examples until you can do them all correctly in the time allowed.

PRACTICE TEST IN DECIMALS IV

You should be able to find the answers to the following examples in less than 10 minutes.

1. Express as decimals: $\frac{2}{5}$, $\frac{2}{3}$, $\frac{1}{6}$, $\frac{16}{25}$, $\frac{17}{75}$.

2. Express as common fractions: .2, .75, .08, .875, $.83\frac{1}{3}$.

3. Find the sum of .4, .6, .7, .9, .1.

4. Subtract: (*a*) 4.625 from 15; (*b*) 37.2 from 38.1.

5. Multiply: (*a*) $7 \times .08$; (*b*) 6.5×5.7; (*c*) $1{,}000 \times .012$.

6. Divide: (*a*) $25\overline{)8.625}$; (*b*) $.2\overline{)72}$; (*c*) $6.48\overline{)7.128}$.

Practice these examples until you can do all of them correctly in the time allowed.

PRACTICE WITH PER CENTS

1. Express as per cents: .07, 1.2, .5.

2. Express as decimals: 6%, 10%, 125%.

3. Find 4% of: 18; 125; 78.

4. 15 = —% of: 30, 60, 10, 5.

DIAGNOSTIC TEST NO. V

This exercise will test your ability to work different kinds of examples.

1. $4\frac{1}{3} + 2\frac{3}{4} - 6\frac{1}{6} =$

2. $8\frac{1}{2} - 4\frac{3}{4} =$

3. $5\frac{1}{2} \times 2\frac{2}{3} \times 3\frac{1}{5} =$

4. $16\frac{2}{3} \div 8\frac{1}{3} =$

5. Find the sum of .004, 1.7. 368, and .04.

6. Subtract 6 from 9.125.

7. Find the product of 30 and 7.5.

8. Divide 17.28 by 90.

9. Express $\frac{3}{4}$ as a decimal and as a per cent.

10. Change $62\frac{1}{2}\%$ to a decimal and to a fraction.

11. Find 6% of 250; 300; 850; 75.

12. What per cent of 200 is 60? 50? 80? 400?

11. 25 = —% of 60.

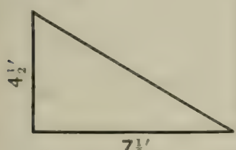
12. 125% of 360 = —.

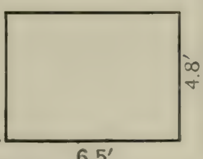
13. Add 4 feet $3\frac{1}{2}$ inches and 5 feet $10\frac{3}{4}$ inches.

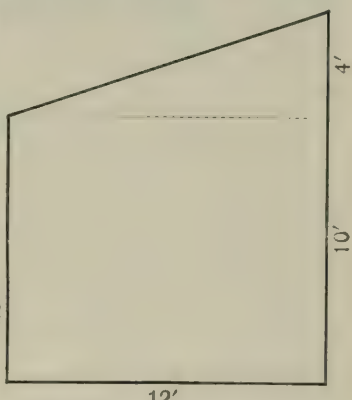
14. Subtract 4 minutes 18 seconds from 5 minutes 17 seconds.

15. Multiply 1 pound 14 ounces by 24.

16. Find the areas of the following:







17. Divide 5 bushels 10 quarts by 10.

18. $\frac{1}{2}$ = —% of 2; 25 = —% of 10?

19. 15% of \$825 = ? 120% of 60 = ?

20. Express .5 as a common fraction, and as per cent.

PROBLEM SCALE V

Standards	
Excellent	9 or 10 correct
Good	7 or 8 correct
Fair	5 or 6 correct
Unsatisfactory	0 to 4 correct

1. Alice spends 18 cents each noon for lunch. How much does she spend for lunches in 6 days?

2. Bananas weigh, on the average, about $\frac{1}{4}$ pound. What do a dozen bananas weigh?

3. How long will 75.6 pounds of sugar last if 1.2 pounds are used each day?

4. Harry can work 10 examples in 4 minutes. How many examples can he work a minute?

5. Mrs. Smith bought 12 cans of 48-cent pears at a sale for 42 cents a can. What did she save?

6. Find the cost of 50 boxes at \$8 a hundred.

7. Mr. Andrews sold 24.5 bushels of potatoes for \$30.38. What was the price a bushel?

8. Jack wished to earn \$18.50 to buy a bicycle. One Saturday he worked $7\frac{3}{4}$ hours for 40 cents an hour. How much more must he earn before he can buy the bicycle?

9. If Frank works for Mr. Smith $\frac{1}{2}$ hour before school and $1\frac{3}{4}$ hours after school each day, how many hours does he work in 6 days?

10. If $\frac{3}{4}$ bushel of peas are needed to plant an acre, how much will the seed for a 5-acre field cost at \$2 a bushel?

CHAPTER VI

SCHOOL SAVINGS BANKS

Many children have deposited money in school savings banks. This table shows how the number of depositors and the total deposits have increased since 1921.

Year	Pupil Accounts	Deposits
1921	1,295,607	$5,775,122
1922	1,907,851	10,631,838
1923	2,236,326	14,991,575
1924	2,454,326	16,961,560
1925	2,869,492	25,913,531
1926	3,403,746	31,984,052
1927	3,815,785	39,137,073

Under each of the following problems select the number which you think is nearest the correct answer. When you have done this for the first 9 problems, do the work necessary to find the correct answer.

1. The increase in the number of pupil accounts from 1921 to 1922 was about 600,000; 450,000; 700,000.

2. The increase in the number of pupil accounts from 1922 to 1923 was about 200,000; 300,000; 400,000.

3. The increase in the number of pupil accounts from 1926 to 1927 was about 400,000; 600,000; 500,000.

4. The average amount deposited a pupil in 1921 was about \$40; \$5; \$12.

5. The average amount deposited a pupil in 1922 was about \$10; \$5; \$19.

6. The average amount deposited a pupil in 1923 was about \$75; \$10; \$7.

7. The average amount deposited a pupil in 1924 was about \$5; \$8; \$80.

8. The number of pupils in 1927 was about 2, $2\frac{1}{2}$, 3, 5 times the number in 1921.

9. The total deposits in 1927 was about 2, 6, 4, 8 times the total deposits in 1921.

*__10.__ If there is a school savings bank in your school, find how many pupils have accounts, the total deposits for some week, and the average deposit a pupil.

THE MEANING OF INTEREST

1. Harry rented a rowboat at a summer camp for $2\frac{1}{2}$ hours at 20¢ an hour. What did he pay for the use of the boat?

2. Mr. Lewis borrowed $100 from his bank. The bank charged 6% a year for the use of the money. If Mr. Lewis kept the loan for one year, how much must he pay the bank?

The sum which Harry paid for the use of the rowboat is called *rent*. The sum which Mr. Lewis paid for the use of the $100 is called *interest*. Interest is money paid for the use of money.

HOW INTEREST IS PAID

When Harry's class began to deposit money in the savings bank, his teacher told the pupils that the bank would pay 4% interest a year for the use of the money. Banks usually pay half the yearly interest every six months, although some pay by the year.

1. Suppose that you lent someone $50 at 4% a year interest. For the use of the money for one year, he would pay 4 per cent of $50.00. How much is 4 per cent of $50?

Think: 4% of $50 =
.04 × $50 = $2.00, interest for one year.

2. If he kept the money for two years, how much would be the interest on $50 at 4%?

Think: 4% of $50 = $2.00, the interest for one year.
2 × $2.00 = $4.00, the interest for 2 years.

3. Find the interest on $200 for 1 year at 4%.

4. Find the interest on $150 for 3 years at 6%.

5. Find the interest on $100 for 6 months at 4% a year.

Think: 6 mo. = ? year.

6. If you lend someone $100 at 6% interest, and he pays the loan with interest at the end of a year, how much money does he pay?

Think: 6% of \$100 = \$6.00, interest for 1 year.
\$100 + \$6 = \$106, the amount he pays.

Find the interest on the following:

7. \$200 for 1 year at 6%.

8. \$300 for 2 years at 5%.

9. \$400 for 3 years at 4%.

10. \$450 for 6 months at 6%.

11. \$840 for 1 year 6 months at 5%.

12. \$900 for 2 years at $6\frac{1}{2}$%.

13. What is the interest on \$100 for 4 months at 6% a year?

Think: 4 months = $\frac{4}{12}$ year = $\frac{1}{3}$ year.

Find the interest on the following:

14. \$200 for 8 months at 8%.

15. \$300 for 3 months at 6%.

16. \$400 for 1 year 3 months at 7%.

17. \$850 for 10 months at 4%.

18. \$950 for 2 years 4 months at $4\frac{1}{2}$%.

19. \$250 for 1 year 5 months at 8%.

20. If you deposit \$25 in a savings bank which pays 4% interest a year, payable semi-annually, what will be the total amount on deposit at the end of 6 months?

Think: Semi-annually means every six months. Since 6 months is $\frac{1}{2}$ year, the semi-annual interest would be $\frac{1}{2}$ of 4% or 2%. 2% of \$25 = ?

Find the semi-annual interest on the following:

21. \$100 at 6%

22. \$250 at 4%

23. \$800 at 8%

24. \$900 at 7%

25. \$600 at $3\frac{1}{2}$%

26. \$750 at $4\frac{1}{2}$%

27. \$840 at 6%

28. \$725 at 4%

SOME SPECIAL WORDS USED IN INTEREST PROBLEMS

The sum of money on which interest is paid is called the *principal.*

The length of time for which interest is paid is called the *time.*

The per cent of interest that is paid is called the *rate of interest.*

The principal plus the interest due is called the *amount.*

Find the interest and the amount in the following:

	Principal	Rate of Interest	Time	Interest	Amount
1.	\$200	6%	2 yr.	?	?
2.	\$400	4%	2 yr.	?	?
3.	\$174	8%	3 yr.	?	?
4.	\$250	5%	$1\frac{1}{2}$ yr.	?	?
5.	\$ 75	4%	6 mo.	?	?
6.	\$375	6%	8 mo.	?	?

7. Julia's father borrowed \$375. He repaid the loan at the end of 6 months with interest at 6 per cent. What was the amount?

8. Which is greater, the amount of a loan of \$600 at 5 per cent for 2 years, or the amount of a loan of \$575 at 4 per cent for 3 years?

PROMISSORY NOTES

A man in business often borrows money. He gives the lender a *promissory note,* which is a written promise to pay the money within a certain length of time with interest as stated in the note. The man who borrows the money is called the *maker* of the note, and the man who lends him the money is called the *payee.* The amount of money borrowed is called the *face* of the note.

There are several different kinds of promissory notes. The note shown below is an interest-bearing promissory note.

$200 SEATTLE, WASH., July 3, 19—

Eight months AFTER DATE, I PROMISE TO PAY TO

THE ORDER OF John Anderson

Two hundred and no/100 DOLLARS

AT The Inland Empire Bank

FOR VALUE RECEIVED, WITH INTEREST AT 6 %.

Wm. J. Pelo

1. How much money was lent?

2. Where was the note made? when? Who is the maker? the payee?

3. For how long a time was the money lent? On what date was it due? Where was it payable?

4. What was the rate of interest? How much interest must Wm. J. Pelo pay for the money that he borrowed?

5. If this money had been lent for three months, when would it have been due?

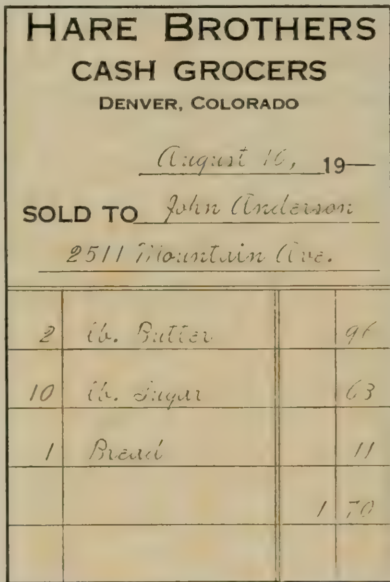
6. If it had been lent for four months, when would it have been due?

7. If the note had been due in 60 days, on what date would it have been due? (Do not count July 3.)

*8. Write in complete form a promissory note for $40. Make yourself the maker and some friend the payee. Make the note for 60 days from today with interest at 6%. Find when the note will come due, and the amount due the payee at maturity.

SALES SLIPS

When a customer buys groceries at a store, the clerk usually writes a sales slip listing the articles of merchandise, the cost of each item, and the total cost. Here is a picture of a sales slip.



HARE BROTHERS
CASH GROCERS
DENVER, COLORADO

August 10, 19—

SOLD TO John Anderson

2511 Mountain Ave.

2	lb. Butter		96
10	lb. Sugar		63
1	Bread		11
		1	70

Hare Brothers are called *retail dealers*, because they sell directly to consumers. Hare Brothers sell only for cash. They do not have *charge accounts*.

Make out sales slips for each of the following orders. Use local prices.

1. Mrs. Harry Teal,
327 South Ann St.
2 lb. butter
$\frac{1}{2}$ doz. eggs
5 lb. sugar
$1\frac{1}{2}$ lb. lard

2. Thomas Farley,
264 Harriet St.
1 pk. potatoes
1 doz. bananas
3 cans of corn

3. James Hobson.
316 Maple Ave.
3 cans tomatoes
2 lb. lard
2 doz. eggs
5 cans tomato soup

4. Harry Steel,
6420 Dupont Ave.
3 cans vegetable soup
$1\frac{1}{2}$ doz. eggs
1 lb. cookies

5. Mrs. Elizabeth Morton,
18 Bethany Block
$\frac{1}{2}$ pk. potatoes
1 can Crisco
3 glasses peach jelly
3 lb. onions

CASH AND CREDIT

A store which keeps an account of an entire month's purchases to be paid for when the month's bill is presented is said to be doing a *credit* business.

If a store does a credit business, its customers are given sales slips. Sometimes the sales slips give only the items purchased and the amount of the order. Sometimes, as in the following sales slip, they also contain a statement of the amount of money due the store for purchases made previously.

JOHNSON'S GROCERY

TENTH AND JACKSON

Minneapolis, January 7, **19**—

James Lewis,
2511 Garfield Ave., South,
Minneapolis, Minn.

BALANCE FORWARDED			10	61
2 lb. butter		96		
1 lb. cheese		42		
1 doz. eggs		37		
10 bars soap		45	2	20
Received payment			12	81
February 6, 19—				
Johnson's Grocery By Logan Smythe				

1. To whom was the sales slip made out?

2. "Balance Forwarded" indicates the amount due the store from purchases made previously. What amount should appear in this place on the next sales slip?

ARITHMETIC OF A CLERK

A Grocery Clerk's Arithmetic

The following sales were made by a clerk in a grocery store. Find the amount of each sale.

1. $4\frac{1}{2}$ pounds of lard @ 22¢ a pound.
2. $2\frac{1}{4}$ pounds of coconut @ 32¢ a pound.
3. $\frac{1}{2}$ pound of crackers @ 21¢ a pound.
4. 8 eggs @ 30¢ a dozen.
5. 6 bushels of potatoes @ $1.76 a bushel.
6. 5 pounds of sugar @ $7\frac{1}{2}$¢ a pound.

A Dry Goods Clerk's Arithmetic

Find the cost of:

7. $3\frac{1}{2}$ yards of gingham @ 56¢ a yard.
8. $5\frac{1}{4}$ yards of voile @ 31¢ a yard.
9. $\frac{3}{4}$ yard of ribbon @ 20¢ a yard.
10. $8\frac{3}{4}$ yards of muslin @ 19¢ a yard.
11. 15 handkerchiefs @ 25¢ each.
12. $22\frac{3}{4}$ yards of trimming @ 20¢ a yard.

Give these products mentally:

13. $1\frac{1}{2} \times 12$
14. $1\frac{3}{4} \times 16$
15. $2\frac{1}{2} \times 10$
16. $3\frac{1}{3} \times 15$
17. $2\frac{1}{4} \times 20$
18. $4\frac{1}{8} \times 16$
19. $12 \times 4\frac{1}{2}$
20. $6 \times 1\frac{3}{4}$
21. $7 \times 2\frac{1}{2}$
22. $4 \times 2\frac{3}{4}$
23. $5 \times 3\frac{1}{5}$
24. $6 \times 2\frac{1}{4}$
25. $1\frac{1}{8} \times 16$
26. $5 \times 12\frac{1}{2}$
27. $8 \times 5\frac{1}{4}$
28. $6 \times 3\frac{7}{8}$
29. $2 \times 3\frac{5}{8}$
30. $4\frac{3}{4} \times 10$

Find the cost of the following:

31. 12 ounces of coconut at 28¢ a pound.
32. 18 inches of ribbon at 40¢ a yard.
33. 2 pecks of potatoes at $1.20 a bushel.
34. 1 pound 2 ounces of cheese at 48¢ a pound.
35. 2 pounds 8 ounces of meat at 40¢ a pound.

MAKING OUT RECEIPTS

At the beginning of each month Jack Andrews collected from each of the customers on his newspaper route. He gave receipts for the money. This is one of the receipts.

$ .70 Philadelphia, Pa., July 3, 19—

Received of Frederick Ortung

Only 70/100 ———————— Dollars

for the month of June.

Jack Andrews

Carrier

1. To whom did Jack give the above receipt?
2. How much money did Jack receive?
3. Make a list of the items included in the receipt.
4. Why did Jack give receipts to his customers?

In place of a separate receipt, the bill may be receipted as shown on page 384.

5. Why is it a good plan for people to save receipts?
6. Make out a bill for the following items. Use the name of some local store as the name of the firm making out the bill. Receipt the bill.

$4\frac{1}{2}$ yd. cloth.....@	$.70	Misses' hat.......	$3.75
$6\frac{3}{4}$ yd. cloth.....@	.35	Misses' dress.....	18.00

7. Make out a receipt for money that you might receive from some classmate for tickets sold for a school play.
8. Why are receipts usually not given by small stores for cash sales?

BILLS AND STATEMENTS

Below is a monthly bill of purchases made by a person who had an account at a department store.

JOHNSON MERCANTILE CO.
17 SOUTH FIFTH STREET
PHILADELPHIA, PA.

January 3, 19—

SOLD TO James Anderson
2511 Garfield Avenue
Wayne, Pa.

Terms: All bills of each month due and payable on or before the 10th of the following month. No receipts given unless requested. $

DATE	MEMO.	CHARGES	CREDITS	BALANCE
[illegible]	2 [illegible]	1 80		1 [illegible]
[illegible]	4 shirts	[illegible]		[illegible]
[illegible]	Ret. 2 shirts		2 [illegible]	[illegible]
[illegible]	pr. gloves	2 25		[illegible]
[illegible]	[illegible]	[illegible]		[illegible]

OUR BOOKS SHOW YOUR BALANCE TO BE LAST AMOUNT IN THIS COLUMN

1. What company sent the bill?
2. To whom was the bill sent? Where did he live?
3. In what month were the purchases made?
4. When was the bill payable?
5. Why are the dates given?
6. Why are the names of articles purchased listed?
7. What is meant by charges? by credits? by balance?

No. 15 $ 2.40

December 10, 19—

To Dayton Company

For Magazine

Balance brought forward	57	26
Amount deposited		
Total	57	26
Amount this check	2	40
Balance carried forward	54	86

8. Why did Mr. Anderson receive credit for the two shirts returned?

9. What was the total amount due the company?

10. Check the bill to see if the balances are correct.

***11.** Rule bill forms like the bill on page 387. Use your name as that of the buyer. Let someone in the class be the seller. Make up a list of items suggested by each of the following topics. Find the cost of each item. Then find the total of each bill.

a. equipment for baseball

b. equipment for Girl Scout

c. supplies for a party

d. tools for a tool chest

PAYING BILLS WITH CHECKS

Checks are used frequently in the payment of bills because they are convenient, and because a canceled check is a receipt for the sum on its face.

1. On what date was the check on page 389 written?

2. What is the number of the check? Why do people number their checks?

3. What is the name of the bank?

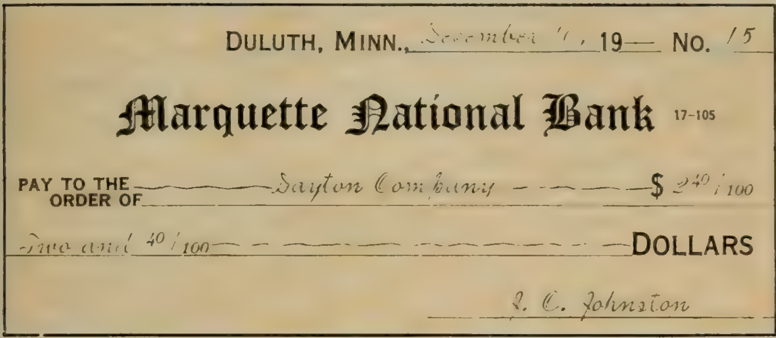
4. Where is the bank located?

5. For how much money was the check made out?

6. To whom is the money to be paid?

7. Who signed the check?

8. Why is the amount of money indicated both by number and by word?



DULUTH, MINN., December , 19— No. 15

Marquette National Bank 17-105

PAY TO THE ORDER OF Dayton Company $ 2 40/100

Two and 40/100 DOLLARS

J. C. Johnston

9. Mr. Johnston keeps, on a stub (page 388), a record of each check that he writes. Explain each entry on the stub.

10. What does *Pay to the order of* mean?

When Dayton Company receives the check, they *indorse* it by writing, or stamping, the name of the company on the back of the check. Then the bank cashes the check and stamps *Paid* on the check. At the end of the month the bank lists all of Mr. Johnston's checks on a statement and returns them to him.

11. Choose the name of a bank and make out a check in payment of one of the following bills. Use the picture of the check above as a model.

12. J. Dreiman, grocer, $35.26.

13. H. C. Smith, florist shop, $3.75.

14. J. B. Andrews, garage, $8.00.

15. Joseph Buchanan, coal dealer, $17.50.

16. George Mansley, plumber, $84.06.

*__17.__ May a person write a check which he can cash himself?

*__18.__ Are checks from your local bank like the one shown above?

BALANCING CASH ACCOUNTS

Boys and girls should learn to keep an account of all the money they receive and pay out. Such an account is called a *cash account.* At the end of the month cash accounts should be *balanced.*

Study carefully the following cash account which was kept by Harry Wilson for the month of August:

RECEIVED					PAID OUT				
19—					19—				
Aug.	1	On hand	5	30	Aug.	4	Ticket, ball game		25
	9	Allowance	2	50		11	Picnic expenses		54
	16	Mowing lawn	1	25		19	Baseball	1	25
	18	Caddying		90		23	Cap		90
	24	Errands		75		26	Gift for Tom	1	00
	27	Caddying		50		31	Balance		?
				?					?
Sept.	1	On hand		?					

1. Balance the account as follows:

a. Find how much Harry paid out in August.

b. Find the amount of cash on hand at the beginning of the month and the money received during the month.

c. The difference between these sums should equal the amount that Harry had left at the end of the month, or the balance. Harry had $7.26 left at the end of the month. Does this check with his account? If it does, we say that the account *balances.*

2. What amount will Harry write as *Cash on hand* on September 1?

3. Keep a personal cash account for one week.

MAKING OUT ACCOUNTS

Rule an account form like the one used by Harry Wilson. Enter the following transactions and balance the accounts.

1. Tom Wilson's account for August:

Aug. 1. Balance from July, \$5.25
Aug. 3. Earned by errands, 35¢
Aug. 5. Spent for baseball, \$1.50.
Aug. 10. Earned for washing car, \$1.25
Aug. 15. Received monthly allowance, \$1.00
Aug. 18. Sold baseball bat to Jim Rogers, 65¢
Aug. 23. Received for working in garden, 75¢
Aug. 25. Paid for repair of bicycle, 60¢
Aug. 27. Received for helping George Brown on his newspaper route, \$1.75
Aug. 30. Put in savings bank, \$2.50.

2. Mabel Serle's account for December:

Dec. 1. Balance from November, \$9.80
Dec. 5. Received for helping mother, \$2.50
Dec. 7. Paid for material for Christmas presents, \$1.40
Dec. 9. Bought Christmas seals, \$.50
Dec. 15. Received monthly allowance, \$2.50
Dec. 18. Received present from Aunt Sarah, \$5.00
Dec. 19. Paid for Christmas presents, \$3.00
Dec. 20. Paid for stamps, 25¢
Dec. 21. Deposited in school savings bank, \$2.00
Dec. 22. Hair cut, 50¢
Dec. 23. Present for Kate, \$1.10
Dec. 24. Earned at store, \$1.50
Dec. 25. Movie, 25¢
Dec. 26. Movie, 25¢
Dec. 28. Mailed package, 28¢
Dec. 30. Earned at store, \$1.50

A FAMILY BUDGET

The average amounts spent for different purposes in a year by a family of five persons are as follows:

		Amount	Per Cent	Amount a Month
Food		$774	?	?
Clothing:				
Husband	$120			?
Wife	166			?
Boy (11 yr.)	96			?
Girl (5 yr.)	82			?
Boy (2 yr.)	47			?
Total		?	?	?
House, fuel, and light		428	?	?
Miscellaneous		547	?	?
Total		?	?	?

1. What was the total amount spent for clothing?

2. What was the total amount spent for all items?

3. What per cent of the total was spent for food? for clothing? for house, fuel, and light? for miscellaneous items?

4. What should the sum of these per cents equal?

5. How much is allowed a month for food? for each of the other items?

A plan for spending an amount of money is called a *budget*.

6. According to the table, how much did the 11-year-old boy spend a month for clothing? Does this seem to you to be enough?

***7.** Prepare a list of the articles of clothing that you need in a year, and estimate their total cost.

FINDING DISCOUNTS AT PER CENT-OFF SALES

Helen bought a \$5.00 sweater at a 20%-reduction sale. What did she pay for the sweater?

> Think: The reduction was 20% of \$5.00.
> **20% of \$5.00 = .20 × \$5.00 = \$1.00.**
> Helen therefore paid **\$5.00 – \$1.00**, or **\$4.00** for the sweater.

Find the selling prices of the following:

	Regular Price	Per Cent Off	Reduction	Selling Price
1. Shoes	\$4.50	10%	?	?
2. Bicycle	\$24.00	25%	?	?
3. Skates	\$3.75	20%	?	?
4. Book	\$2.50	50%	?	?
5. Scissors	\$1.20	$33\frac{1}{3}$%	?	?
6. Sweater	\$4.56	25%	?	?
7. Shovel	\$2.25	20%	?	?
8. Baseball	\$1.80	5%	?	?
9. Overcoat	\$32.00	$12\frac{1}{2}$%	?	?
10. Dress	\$16.00	30%	?	?

11. Mrs. Smith went to a sale to buy a suit for Jack and a coat for Mary. She bought a \$25 suit for Jack at 20% off, and a \$30 coat for Mary at 25% off. How much did she save by buying the suit and coat at the sale?

12. Jack bought a bicycle for \$30. After he had used it two years, he offered it for sale at a reduction of 40%. What did he ask for the bicycle?

13. Arthur's father bought an automobile for \$1,000. After he had used it a year, he advertised it for sale at 20% reduction. What was his selling price?

FINDING THE PER CENT REDUCTION

Harry saw a \$24 bicycle advertised for \$18.00. What was the reduction in price? What per cent was that of the regular price?

Think: The reduction was \$6.00 (\$24.00 − \$18.00 = \$6.00)
\$6.00 is what per cent of \$24.00?

Find the per cent off on each of the following:

	Regular Price	Sale Price	Reduction	Per Cent Reduction
1. Field glasses........	\$8.00	\$6.00	?	?
2. Automobile tire.....	16.00	12.00	?	?
3. Cushion...........	5.00	3.50	?	?
4. Cookbook..........	3.60	3.24	?	?
5. Tent..............	25.00	15.00	?	?
6. Camera............	22.50	20.00	?	?

A MIXED DRILL

Practice this exercise until you can find the answers to each of the two sets in less than 8 minutes:

Set I

	a	*b*	*c*
1.	$\frac{1}{4}$ of 200 =	75% of 1,000 =	60% of 50 =
2.	$\frac{1}{3}$ of 600 =	.4 of 25 =	$\frac{5}{8}$ of 160 =
3.	$12\frac{1}{2}$% of 96 =	$83\frac{1}{3}$ × 12 =	$16\frac{2}{3}$% of 48 =
4.	$.66\frac{2}{3}$ × 1,200 =	$62\frac{1}{2}$% of 160 =	56 = 14 × —
5.	$\frac{1}{2}$ of 20 =	84 = —% of 144	45 = —% of 75

Set II

	a	*b*	*c*
1.	$66\frac{2}{3}$% of 1,500 =	$.62\frac{1}{2}$ × 240 =	50% of 20 =
2.	.8 of 250 =	20% of 400 =	.375 × 80 =
3.	$\frac{1}{6}$ of 48 =	$.33\frac{1}{3}$ × 600 =	$\frac{4}{5}$ of 250 =
4.	.875 × ? = 70	$\frac{2}{3}$ of 1,200 =	48 = —% of 64
5.	$\frac{2}{5}$ of 25 =	$\frac{5}{6}$ of 12 =	475 = — × 125

DISCOUNTS FOR CASH

In order to encourage prompt payment, many business concerns allow a discount if bills are paid before a certain date. Sometimes the discount is a certain amount of money. Sometimes it is a certain per cent of the bill.

The Brown family received the following bills:

1. A telephone company charged $3.00 for telephone service if the bill was paid before the 15th of the month. After the 15th, the bill became $3.50. How much was the discount? What per cent of $3.00 is this? What per cent of $3.50?

2. The gas bill amounted to $4.20. Five per cent discount was allowed if the bill was paid before the 20th of the month. The bill was paid on the tenth of the month. How much was paid by Mr. Brown?

3. An electric bill amounting to $3.24 was sent to Mr. Brown. A discount of 2% was allowed if the bill was paid before the 27th of the month. Mr. Brown paid the bill on the 25th. What was the amount of the discount?

4. Mrs. Brown had a charge account at a department store. The bill for the month amounted to $24. The store gave stamps worth 1 cent for each dollar, if the bill was paid before the tenth of the month. What was the value of the stamps Mrs. Brown received if she paid the bill on the second of the month?

5. What was the amount the Browns saved this month by paying their bills before they were due?

6. At this rate, what amount would they save in one year?

***7.** What discounts are allowed by some of the business houses in your community?

PROFIT AND LOSS

1. Mary Andrews planted a garden. She paid \$.75 for seed. She sold \$5.25 worth of vegetables and flowers to the neighbors. What was her *gross* profit?

To find *gross profit*, subtract the money Mary spent for seed from the amount she received. \$5.25 − \$.75 = ?

2. Mary had to spend \$.45 for insect poison during the summer. What was her net profit?

To find *net profit*, subtract the amount Mary spent for insect poison from her gross profit.

3. A grocer bought 80 bushels of potatoes at \$1.75 a bushel and sold them at \$2.25 a bushel. What was his gross profit on a bushel? on the 80 bushels?

4. The grocer estimated that the cost of selling the potatoes was \$.30 a bushel. What was his net profit on a bushel of potatoes? on the 80 bushels?

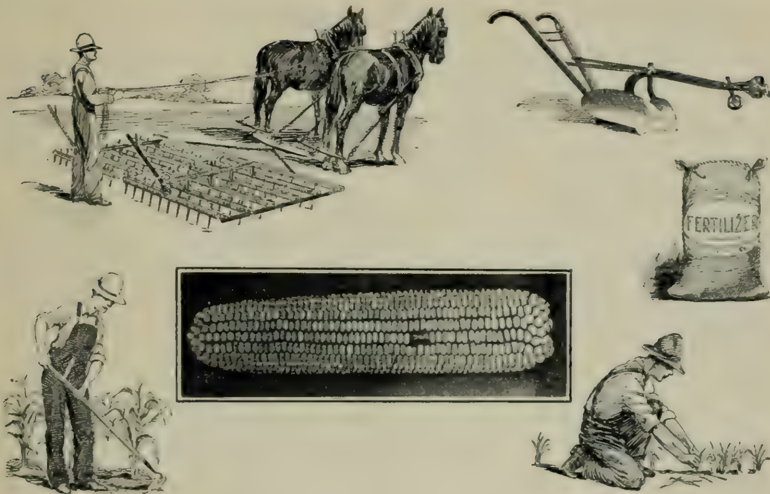
5. Harry Johnson bought 24 toy balloons for 5¢ each. The wind blew 14 of them away. He sold the rest for 10¢ each. Did he gain or lose, and how much?

Whenever one sells a thing for less than it costs, one is said to sell at a *loss*.

6. A shoe merchant bought a pair of shoes for \$4.25 and sold them for \$5.25. Would it be correct to say that his net profit was \$1? Why?

7. A farmer sold 425 bushels of wheat at \$1.29 a bushel. He estimated the cost of raising the wheat at \$.65 a bushel. He paid \$14.65 for freight and \$8.79 to the broker who sold the wheat for him. What was his net profit?

8. What is the net profit of a dealer on a sale of \$4,000, if his rate of net profit is $6\frac{1}{2}\%$ of sales?



A CORN PROJECT

Henry Mann lived on a farm. He decided that he would raise a field of seed corn. Mr. Mann agreed to rent Henry a three-acre field at $8 an acre for the season. Henry was to pay for the seed and pay all expenses of preparing the ground.

1. Henry used a half bushel of seed corn which was sold for $7.00 a bushel. What did the seed corn cost Henry?

2. How many pounds does a bushel of shelled corn weigh? How many pounds of seed did he plant an acre?

The record of Henry's expenses is on page 398.

3. Find the total cost of the man labor which Henry hired.

4. Henry husked the corn himself. He worked 15 hours. At 30¢ an hour, what was his labor worth?

5. Find the cost of the horse labor for each kind of work.

LABOR RECORD

Work	Hired Man Labor			Horse Labor			Use of Implements		
	Hours	Price an Hour	Total Cost	Hours	Price an Hour	Total Cost	Hours	Price an Hour	Total Cost
Spring Work:									
Plowing......	24	\$.30	?	72	\$.12	?	24	\$.06	?
Disking......	$9\frac{1}{3}$	.30	?	28	.12	?	$9\frac{1}{3}$	.06	?
Dragging.....	3	.30	?	9	.12	?	3	.06	?
Planting.....	$4\frac{1}{2}$	.30	?	9	.12	?	$4\frac{1}{2}$	.06	?
Summer Work:									
Cultivating...	24	.30	?	30	.12	?	30	.06	?
Fall Work:									
Husking.....	—	—	—	15	.12	?	15	.06	?
Totals.....	?	.30	?	?	.12	?	?	.06	?

6. Find the total cost of the horse labor.

7. What was the total cost of the labor for which Henry had to pay? Would you count Henry's own labor? Explain.

8. How much did Henry pay for the use of the implements?

9. In the fall Henry harvested 250 bushels of corn from the three acres. How many bushels was this an acre?

10. Corn was selling at 98¢ a bushel. What did Henry receive for his corn?

11. Make a list of Henry's total expenses for the season.

Cost of seed..............................	______
Cost of hired labor.......................	______
Cost of horse labor.......................	______
Rent of field.............................	______
Use of implements.........................	______
Total.....................................	______

12. What was Henry's profit on his corn project?

THE DIFFERENCE BETWEEN MARGIN AND PROFIT

1. My father buys eggs, cream, butter, fruit, and vegetables from farmers and sells them to his customers. Today he bought 14 dozen eggs from Mr. Smith at 25¢ a dozen. What was the total cost of these eggs?

2. My father fixed a price of 28¢ a dozen for the eggs. He calls the difference between what he pays for the eggs and what he gets for them his *margin*. What was his margin on 1 dozen eggs? If he sold all the eggs he bought from Mr. Smith at 28¢ a dozen, what was his total margin?

3. He said 3¢ was a narrow margin on which to sell the eggs. If he had sold the eggs at a margin of 6¢ a dozen, (***a***) what would the selling price a dozen have been? (***b***) At this price, what would he receive for the 14 dozen eggs? My father said that 6¢ a dozen would be a *wide margin*.

4. We buy breakfast food by the case. One kind has 18 boxes to the case. It costs $2.88 a case. What does it cost a box?

5. We sell this breakfast food at 20¢ a box. What is the margin on a box? on a case?

6. Last week, we bought two dozen baskets of grapes for $3.60. What did they cost a basket?

7. We sold 17 baskets during the week at 25¢ a basket.

a. How much did we get for them?

b. How much did these 17 baskets cost?

c. How much was our total margin on them?

8. On Monday the grapes which we had left did not look fresh, and we had to sell the baskets at cost.

a. How much did we receive for these baskets if we sold all of them at cost?

b. How much was the total amount which we received for the 24 baskets of grapes?

c. How much was our total margin on the sale of all the grapes?

9. Last week we bought 36 baskets of peacnes at 22¢ a basket.

a. How much was the total cost of these peaches?

b. We sold $\frac{1}{2}$ of the baskets at 30¢ a basket. How much did we receive for them?

c. The rest partly spoiled. To get rid of them we offered them at 15¢ a basket. We sold 9 baskets at this price. How much did we get for all we sold at this price?

d. We had to throw away the rest. How many baskets did we throw away?

e. How much did we receive for all the peaches sold?

10. If we buy some dairy butter at 45¢ a pound, and sell it at a margin of $\frac{1}{5}$ of the cost, what will be the selling price a pound?

My father explained to me the difference between margin and profit. "Some people think," he said, "that if a grocer buys eggs at 40¢ a dozen and sells them at 45¢ a dozen, he makes a profit of 5¢ a dozen on them. This is not his profit, but his margin. The grocer has many expenses. He has, for instance, clerk hire, the rent for the store building, the expenses of the car used in delivering the groceries, the cost of telephone, wrapping paper, advertising, and many other things. To find the profit, the total expenses must be subtracted from the total margin."

11. The week before Christmas our total sales amounted to $2,350. The cost of these goods was $1,726. The expenses of the week were $265. What was our profit?

THE COSTS OF RUNNING A RETAIL STORE

The grocer performs a great many services for the housewife. He assembles a variety of foods, stores them, keeps them in good condition, grades them, pays the expenses of selling and delivering them. For these services we must pay. The table below shows how these costs are distributed in every dollar that we spend. The figures are based on reports from 433 retail grocery stores.

Cost of the material sold	\$.807
Selling expenses, as clerks' wages, advertising, etc.	.078
Delivery	.028
Management	.026
Rent and upkeep	.037
Losses from bad debts	.004
Other expenses	.007
Total expenses	?
Profit	.013

1. When you spend \$1 at a grocery store, what amount is paid by the grocer for the materials that you buy?

2. How much is added to this cost for selling expenses? for delivery? for each of the other items?

3. What profit does the grocer make on the \$1 purchase?

4. Find the total amount that you pay the retailer for running expenses and profits.

5. If a grocer sold \$300 worth of groceries on Saturday, what would his profit be?

6. What items in the grocer's expenses would be removed in a cash-and-carry business?

7. On a \$5 order, how much is the grocer's profit?

HOW PRICES ARE DECIDED UPON

Mary Smith's father buys vegetables, groceries, eggs, and other articles of food from farmers and sells them to people in the city. He adds a certain amount of money to what he pays for the products to cover the expenses of running his store. Usually an amount equal to about 25% or 30% of the cost is added to establish a selling price. Sometimes the selling price must be changed a little to find a price that is easier to deal with. Imagine that you were Mr. Smith, a grocer, and were deciding at what prices to sell certain articles. Add 25% to the price that you pay for each item. Then decide upon a convenient selling price.

	Mr. Smith Paid	Cost Price + 25%	Convenient Selling Price
1. Apples	$1.00 a bushel	?	?
2. Peaches	1.45 a bushel	?	?
3. Potatoes	1.60 a bushel	?	?
4. Carrots	6¢ a pound	?	?
5. Onions	2¢ a bunch	?	?
6. Cherries	11¢ a box	?	?
7. Butter	38¢ a pound	?	?
8. Sweet Corn	15¢ a dozen	?	?

9. How much higher would the selling prices of each have been if Mr. Smith had added 30% to the cost price? Make out a new price list, using 30%, and find the differences in the selling prices.

10. What per cent of the selling price is the margin on each of the products listed in problems **1-8**?

***11.** Many people buy foodstuffs directly from the farmer. Often his prices are lower than those asked in the stores. Why is this?

DIAGNOSTIC TEST IN REDUCTION OF FRACTIONS

1. Reduce the following fractions to lowest terms.

$\frac{9}{12} =$ $\qquad \frac{15}{18} =$ $\qquad \frac{6}{15} =$ $\qquad \frac{6}{8} =$ $\qquad \frac{10}{14} =$

2. Supply the missing terms in each of the following fractions.

$\frac{1}{2} = \frac{}{4} = \frac{}{8} = \frac{}{16} = \frac{}{10} = \frac{}{14}$

$\frac{1}{4} = \frac{}{16} \qquad \frac{1}{8} = \frac{}{16} \qquad \frac{4}{5} = \frac{}{10} \qquad \frac{2}{3} = \frac{}{9} \qquad \frac{3}{4} = \frac{}{8}$

3. Change the following improper fractions to mixed numbers. Express all answers in lowest terms.

$\frac{9}{6} = \qquad \frac{12}{8} = \qquad \frac{19}{12} = \qquad \frac{25}{10} = \qquad \frac{11}{3} = \qquad \frac{14}{5} =$

4. Change the following mixed numbers to improper fractions.

$1\frac{1}{4} = \qquad 2\frac{1}{2} = \qquad 7\frac{1}{3} = \qquad 5\frac{4}{5} = \qquad 8\frac{7}{8} = \qquad 9\frac{3}{11} =$

5. Change these pairs of unlike fractions to fractions with a lowest common denominator. The first example is already worked correctly.

a	*b*	*c*	*d*	*e*	*f*
$\frac{1}{4} = \frac{1}{4}$	$\frac{7}{8} =$	$\frac{1}{3} =$	$\frac{7}{8} =$	$\frac{3}{4} =$	$\frac{5}{6} =$
$\frac{1}{2} = \frac{2}{4}$	$\frac{3}{4} =$	$\frac{4}{5} =$	$\frac{1}{6} =$	$\frac{2}{3} =$	$\frac{3}{4} =$

6. Change $\frac{1}{2}$, $\frac{1}{3}$, and $\frac{1}{4}$ to twelfths.

7. Change $\frac{3}{4}$, $\frac{5}{6}$, and $\frac{7}{8}$ to fractions having a lowest common denominator.

8. Supply the missing numerators in the following:

$7\frac{1}{2} = 6\frac{}{2} \qquad 5\frac{2}{3} = 4\frac{}{3} \qquad 6 = 5\frac{}{4} \qquad 8 = 7\frac{}{5}$

$3\frac{1}{2} = 2\frac{}{4} \qquad 5\frac{2}{3} = 4\frac{}{6} \qquad 9\frac{7}{8} = 8\frac{}{24} \qquad 15\frac{1}{6} = 14\frac{}{18}$

9. Reduce the following to simplest form:

$3\frac{9}{6} = \qquad 8\frac{4}{4} = \qquad 12\frac{12}{11} = \qquad 8\frac{8}{2} =$

10. Express the following as fractional parts of 100:

$12\frac{1}{2}$, $\quad 25$, $\quad 75$, $\quad 50$, $\quad 33\frac{1}{3}$, $\quad 87\frac{1}{2}$

$66\frac{2}{3}$, $\quad 37\frac{1}{2}$, $\quad 40$, $\quad 83\frac{1}{3}$, $\quad 60$, $\quad 62\frac{1}{2}$

DIAGNOSTIC TEST IN ADDITION OF FRACTIONS

Row	1	2	3	4	5
I	$\frac{1}{3}$ $\frac{1}{3}$	$\frac{1}{8}$ $\frac{5}{8}$	$\frac{1}{2}$ $\frac{1}{2}$	$\frac{4}{5}+\frac{2}{5}=$	$\frac{3}{4}$ $\frac{3}{4}$
II	5 $\frac{1}{4}$	$\frac{2}{3}+7=$	4 $1\frac{2}{3}$	$3\frac{1}{2}$ 8	$2\frac{1}{4}+\frac{1}{4}+4=$
III	$3\frac{1}{5}$ $\frac{1}{5}$	$\frac{1}{4}$ $2\frac{1}{4}$	$2\frac{1}{3}+7\frac{2}{3}=$	$3\frac{3}{5}$ $2\frac{4}{5}$	$5\frac{5}{6}+2\frac{5}{6}=$
IV	$\frac{1}{2}$ $\frac{1}{4}$	$\frac{1}{2}+\frac{1}{7}=$	$\frac{1}{4}$ $\frac{1}{2}$ $\frac{1}{4}$	$\frac{1}{3}$ $\frac{5}{6}$	$\frac{7}{12}$ $\frac{3}{4}$
V	$3\frac{2}{3}$ $2\frac{1}{6}$	$1\frac{1}{4}$ $3\frac{7}{12}$	$1\frac{1}{4}$ $\frac{1}{4}$ $2\frac{1}{2}$	$7\frac{3}{4}$ $3\frac{1}{2}$	$2\frac{2}{3}$ $7\frac{5}{6}$
VI	$\frac{1}{4}$ $\frac{1}{3}$	$\frac{1}{3}$ $\frac{1}{5}$ $\frac{3}{10}$	$\frac{3}{4}$ $\frac{1}{6}$ $\frac{1}{8}$	$\frac{3}{5}$ $\frac{1}{2}$ $\frac{1}{4}$	$\frac{2}{3}$ $\frac{4}{5}$ $\frac{7}{10}$
VII	$4\frac{1}{5}$ $1\frac{1}{4}$	$1\frac{1}{6}$ $7\frac{3}{5}$ $3\frac{1}{6}$	$\frac{5}{6}+\frac{3}{4}+\frac{5}{12}=$	$6\frac{2}{3}$ $4\frac{3}{4}$	$5\frac{3}{5}$ $7\frac{1}{4}$ $\frac{1}{4}$
VIII	$5\frac{1}{12}$ $\frac{5}{6}$	$\frac{5}{12}$ $1\frac{1}{3}$	$\frac{2}{3}$ $\frac{1}{4}$ $4\frac{1}{12}$	$\frac{2}{5}$ $1\frac{2}{3}$	$3\frac{17}{24}$ $4\frac{5}{6}$ $3\frac{5}{8}$

DIAGNOSTIC TEST IN SUBTRACTION OF FRACTIONS

Row	1	2	3	4	5
I	$\frac{2}{3}$ $\frac{1}{3}$	$\frac{5}{8}$ $\frac{1}{8}$	$4\frac{4}{5}-\frac{1}{5}=$	$4\frac{2}{3}$ $\frac{2}{3}$	$7\frac{5}{6}$ $\frac{1}{6}$
II	$5\frac{1}{4}$ 3	$2\frac{1}{8}-2=$	$4\frac{3}{5}$ $2\frac{1}{5}$	$3\frac{3}{4}$ $2\frac{3}{4}$	$7\frac{5}{8}-2\frac{3}{8}=$
III	$9-\frac{1}{2}=$	1 $\frac{1}{4}$	3 $1\frac{2}{3}$	$6-5\frac{2}{3}=$	$2\frac{1}{8}$ $\frac{1}{8}$
IV	$6\frac{1}{3}$ $\frac{2}{3}$	$7\frac{1}{8}$ $\frac{5}{8}$	$10\frac{1}{3}$ $3\frac{2}{3}$	$9\frac{3}{5}$ $8\frac{4}{5}$	$4\frac{1}{6}-1\frac{5}{6}=$
V	$\frac{1}{2}$ $\frac{1}{4}$	$\frac{1}{2}-\frac{1}{6}=$	$3\frac{3}{4}$ $\frac{1}{2}$	$6\frac{1}{4}$ $6\frac{1}{8}$	$4\frac{1}{3}$ $\frac{1}{12}$
VI	$7\frac{1}{2}$ $4\frac{2}{4}$	$3\frac{5}{6}-1\frac{2}{3}=$	$7\frac{3}{5}$ $1\frac{1}{10}$	$2\frac{2}{3}-\frac{5}{6}=$	$3\frac{1}{4}$ $\frac{11}{12}$
VII	$\frac{1}{3}$ $\frac{1}{4}$	$\frac{3}{4}$ $\frac{1}{6}$	$2\frac{3}{8}-\frac{1}{3}=$	$4\frac{5}{6}$ $\frac{3}{8}$	$1\frac{1}{8}-\frac{1}{3}=$
VIII	$4\frac{5}{6}-1\frac{2}{5}=$	$3\frac{5}{8}$ $1\frac{1}{6}$	$3\frac{5}{6}-1\frac{3}{4}=$	$8\frac{1}{8}$ $1\frac{1}{2}$	$7\frac{1}{8}-\frac{1}{4}=$
IX	$3\frac{7}{8}-1\frac{11}{12}=$	$4\frac{1}{4}-\frac{5}{6}=$	$3\frac{1}{4}$ $1\frac{2}{3}$	$5\frac{1}{5}-\frac{2}{3}=$	$7\frac{1}{5}$ $6\frac{3}{4}$

DIAGNOSTIC TEST IN MULTIPLICATION OF FRACTIONS

Multiply. When possible, change improper fractions to mixed numbers and common fractions to lowest terms.

Row	1	2	3	4	5
I	$\frac{1}{4}\times 8=$	$\frac{1}{9}$ of $3=$	$\frac{2}{5}\times 2=$	$\frac{2}{3}\times 16=$	$\frac{5}{6}\times 14=$
II	$2\times\frac{4}{9}=$	$3\times\frac{1}{3}=$	$4\times\frac{1}{2}=$	$12\times\frac{1}{5}=$	$8\times\frac{1}{6}=$
III	$\frac{1}{4}$ of $\frac{1}{6}=$	$\frac{1}{4}\times\frac{8}{9}=$	$\frac{1}{2}\times\frac{7}{10}=$	$\frac{5}{9}\times\frac{3}{7}=$	$\frac{5}{8}\times\frac{16}{25}\times\frac{1}{2}=$
IV	$6\times 2\frac{1}{3}=$	$7\times 4\frac{1}{2}=$	$6\times 3\frac{3}{4}=$	$2\times 4\frac{1}{5}=$	$6\times 3\frac{3}{8}\times 2\frac{4}{5}=$
V	$2\frac{1}{4}\times\frac{1}{4}=$	$3\frac{1}{5}\times 2=$	$3\frac{1}{6}\times 4=$	$3\frac{2}{3}\times 8=$	$5\frac{3}{8}\times 6\times 2\frac{1}{3}=$
VI	$\frac{1}{4}\times 2\frac{1}{2}=$	$\frac{1}{2}$ of $1\frac{1}{5}=$	$\frac{5}{8}\times 6\frac{2}{5}=$	$\frac{2}{5}\times 3\frac{2}{3}=$	$\frac{2}{3}\times 4\frac{3}{4}\times\frac{2}{3}=$
VII	$3\frac{1}{3}\times\frac{2}{9}=$	$3\frac{1}{3}\times\frac{1}{8}=$	$7\frac{1}{2}\times\frac{2}{5}=$	$6\frac{4}{5}\times\frac{3}{7}=$	$3\frac{1}{5}\times\frac{3}{8}\times\frac{8}{9}=$
VIII	$2\frac{1}{2}\times 2\frac{1}{4}=$	$6\frac{1}{4}\times 6\frac{2}{5}=$	$3\frac{3}{4}\times 3\frac{1}{3}=$	$3\frac{2}{7}\times 2\frac{2}{3}=$	$4\frac{3}{8}\times 2\frac{6}{7}\times 1\frac{4}{5}=$
IX	24 $3\frac{1}{8}$	$36\frac{5}{6}$ 12	18 $15\frac{3}{4}$	$25\frac{1}{2}$ 27	23 $18\frac{3}{5}$

DIAGNOSTIC TEST IN DIVISION OF FRACTIONS

Divide. Reduce all fractions in the answers to lowest terms.

Row	1	2	3	4	5
I	$5 \div \frac{1}{2} =$	$5 \div \frac{2}{3} =$	$12 \div \frac{3}{4} =$	$14 \div \frac{4}{5} =$	$2 \div \frac{4}{5} =$
II	$\frac{1}{7} \div \frac{1}{6} =$	$\frac{1}{9} \div \frac{1}{3} =$	$\frac{3}{8} \div \frac{3}{8} =$	$\frac{13}{15} \div \frac{1}{2} =$	$\frac{5}{6} \div \frac{3}{10} =$
III	$1\frac{1}{4} \div \frac{1}{3} =$	$1\frac{1}{2} \div \frac{1}{2} =$	$1\frac{3}{8} \div \frac{3}{10} =$	$2\frac{5}{8} \div \frac{3}{4} =$	$9 \div 8 =$
IV	$\frac{1}{5} \div 5 =$	$\frac{5}{6} \div 4 =$	$\frac{5}{9} \div 5 =$	$\frac{4}{5} \div 6 =$	$10 \div 6 =$
V	$1\frac{1}{3} \div 5 =$	$1\frac{1}{5} \div 4 =$	$5\frac{2}{3} \div 5 =$	$5\frac{3}{5} \div 2 =$	$4\frac{3}{5} \div 6 =$
VI	$\frac{1}{3} \div 1\frac{1}{2} =$	$\frac{3}{8} \div 1\frac{2}{3} =$	$\frac{5}{12} \div 1\frac{5}{6} =$	$\frac{1}{6} \div 1\frac{1}{2} =$	$8 \div 14 =$
VII	$2 \div 2\frac{1}{2} =$	$3 \div 4\frac{1}{2} =$	$5 \div 2\frac{3}{4} =$	$5 \div 2\frac{1}{2} =$	$12 \div 6\frac{3}{5} =$
VIII	$1\frac{1}{5} \div 3\frac{1}{2} =$	$1\frac{1}{3} \div 3\frac{1}{3} =$	$2\frac{3}{8} \div 2\frac{3}{8} =$	$3\frac{1}{3} \div 1\frac{3}{4} =$	$3\frac{3}{8} \div 1\frac{1}{4} =$

DIAGNOSTIC TEST IN ADDITION OF DECIMALS

Find the following sums correctly:

1.	.4	**3.**	.3	**5.**	.16	**7.**	.28	**9.**	.02
	.1		.5		.25		.43		.03
	.3		.8		.37		.95		.04
2.	.05	**4.**	1.06	**6.**	1.75	**8.**	2.75	**10.**	3.26
	.09		2.08		2.125		4.		.04
	.08		3.04		3.8		16.375		1.1

11. Find the sum of 9.65, 8.375, and 6.4.

12. Find the sum of .8, 3, and .125.

DIAGNOSTIC TEST IN SUBTRACTION OF DECIMALS

Can you do these subtraction examples correctly?

1.	.8	**5.**	.5	**9.**	.16	**13.**	.38	**17.**	.43
	.3		.5		.04		.15		.41
2.	.375	**6.**	.7	**10.**	.9	**14.**	.4	**18.**	.6
	.269		.35		.275		.375		.004
3.	9.6	**7.**	18.5	**11.**	27.08	**15.**	9.3	**19.**	18.2
	3.4		4.6		15.17		6.25		1.625
4.	18.75	**8.**	.65	**12.**	.375	**16.**	9.637	**20.**	3.748
	1.4		.5		.21		5.		3.7

21. Subtract 3.825 from 20.

22. Subtract .5 from .75.

DIAGNOSTIC TEST IN MULTIPLICATION OF DECIMALS

1. $4 \times .2 =$	**2.** $4 \times .02 =$	**3.** $4 \times .002 =$
4. $5 \times .3 =$	**5.** $6 \times .04 =$	**6.** $7 \times .008 =$
7. $8 \times .5 =$	**8.** $6 \times .05 =$	**9.** $4 \times .005 =$

10. $\begin{array}{r} 2.6 \\ \underline{4} \end{array}$	11. $\begin{array}{r} 3.5 \\ \underline{8} \end{array}$	12. $\begin{array}{r} 3.28 \\ \underline{4} \end{array}$	13. $\begin{array}{r} 4.647 \\ \underline{5} \end{array}$
14. $\begin{array}{r} 85 \\ \underline{.4} \end{array}$	15. $\begin{array}{r} 20 \\ \underline{.6} \end{array}$	16. $\begin{array}{r} 32 \\ \underline{1.4} \end{array}$	17. $\begin{array}{r} 2.5 \\ \underline{48} \end{array}$
18. $.4 \times .2 =$	19. $.5 \times .03 =$	20. $.8 \times .25 =$	
21. $\begin{array}{r} 7.8 \\ \underline{6.4} \end{array}$	22. $\begin{array}{r} 6.5 \\ \underline{4.8} \end{array}$	23. $\begin{array}{r} 18.4 \\ \underline{.26} \end{array}$	24. $\begin{array}{r} 8.04 \\ \underline{.03} \end{array}$
25. $10 \times 8.5 =$	26. $10 \times .96 =$	27. $100 \times .14 =$	
28. $100 \times 8.5 =$	29. $100 \times 8.65 =$	30. $200 \times 9.4 =$	

DIAGNOSTIC TEST IN DIVISION OF DECIMALS

When necessary, carry the work to three places only.

1. $4\overline{)8.4}$	11. $3\overline{)7.47}$	21. $8\overline{)16.896}$
2. $2\overline{).8}$	12. $4\overline{).76}$	22. $6\overline{).972}$
3. $4\overline{).12}$	13. $6\overline{).042}$	23. $24\overline{)1.2}$
4. $8\overline{)4}$	14. $8\overline{)6}$	24. $25\overline{)2}$
5. $25\overline{)64}$	15. $33\overline{)87}$	25. $25\overline{)8.725}$
6. $.3\overline{)3.6}$	16. $.3\overline{)18.63}$	26. $.4\overline{)1.2}$
7. $.3\overline{)6}$	17. $.2\overline{)10}$	27. $.4\overline{)3}$
8. $.7\overline{)4}$	18. $.11\overline{)1.21}$	28. $.11\overline{)1.342}$
9. $.11\overline{)3.3}$	19. $.12\overline{)6}$	29. $.12\overline{)9}$
10. $1.25\overline{)6.75}$	20. $6.48\overline{)7.128}$	30. $.834\overline{)91.74}$

USING ARITHMETIC LANGUAGE

You have learned many things about arithmetic. Study the following questions and be ready to answer them orally. This will be a good test of how well you understand what you have learned.

1. What must you know to find the area of a field?

2. What must you know to find the volume of a box?

3. Why is it necessary to change unlike fractions to a common denominator before adding, or subtracting them?

4. How does cancellation help in finding the answer to an example in which small mixed numbers are multiplied?

5. What does it mean to invert a fraction?

6. How can the fraction $\frac{5}{8}$ be changed to a decimal? to a per cent?

7. How can a decimal be changed to a common fraction?

8. In multiplying two decimals, how many decimal places must be pointed off in the product?

9. Explain the method you use in dividing a decimal by a decimal. You may use an example if you wish.

10. How can you find a per cent of a number?

11. How can you find what per cent one number is of another?

12. What is meant by interest? How is it computed?

13. What is meant by profit and loss?

14. What is the difference between margin and profit?

15. What is discount?

16. What is an account? a sales slip? a bill? a check?

17. What are denominate numbers? compound denominate numbers?

18. Express 3.6¢ as a decimal of a dollar.

19. What does it mean to draw to scale?

20. What is meant by the ratio of two numbers? Name ways of comparing two numbers.

COMMON FRACTIONS, DECIMALS, AND PER CENTS

1. Express the following per cents as common fractions and as decimals: 1%; 8%; 5%; $3\frac{1}{2}$%; 10%; 100%; 20%; $5\frac{1}{4}$%; $22\frac{1}{2}$%; $\frac{1}{2}$ of 1%; $4\frac{1}{2}$%; $12\frac{1}{2}$%; $8\frac{1}{3}$%.

2. Express the following common fractions as decimals and as per cents: $\frac{1}{2}$; $\frac{1}{4}$; $\frac{1}{5}$; $\frac{4}{5}$; $\frac{3}{4}$; $\frac{3}{100}$; $\frac{3}{50}$; $\frac{1}{800}$; $\frac{1}{8}$; $\frac{3}{25}$; $\frac{3}{8}$.

3. Express the following decimals as common fractions or mixed numbers, and as per cents: .03; .12; .125; .45; .05; .005; .045; .032; .55; .002; .825; 1.35; 2.05; 4.025.

4. Find 5% of 100; $.05 \times 100$; $\frac{1}{20}$ of 100.

5. Find $1\frac{1}{4} \times 100$; 125% of 100; 1.25×100.

6. Find $.36 \times 200$; 36% of 200; $\frac{9}{25}$ of 200.

7. Write two fifths as a common fraction, as a decimal, and as a per cent.

8. Which is the greater reduction, $33\frac{1}{3}$% or $\frac{2}{7}$?

APPLICATIONS OF PER CENT

1. One day 30 per cent of a class of 36 children were absent. How many were present?

2. Here are the scores that three pupils made on a test of 20 examples. What per cent did each one have correct?

Harry, 19 examples correct
Alice, 20 examples correct
Jack, 15 examples correct

3. On a test of 25 words, Mary had 92 per cent spelled correctly. How many words did she misspell?

4. One Saturday Harry collected some money for his father. He collected in all \$75. His father gave him 2% of all of the money he collected. How much did Harry receive from his father?

5. Mary's father was a real estate agent. He sold a house for Mr. Jackson for \$10,000. Mr. Jackson paid him 5% of this amount for selling the house. What did Mr. Jackson pay Mary's father?

6. During one month, Patty Lee, Julia's cow, yielded 750 pounds of milk. At the end of the month the creamery paid Julia for 30 pounds of butterfat from this milk. What per cent of the milk was butterfat?

7. Henry bought a puppy for \$2.50 and sold it for \$4.00. What was his gain? What per cent was this of the cost of the puppy?

8. Which would be cheaper, a \$20 chair bought at a "$\frac{1}{3}$-off" sale or a \$20 chair bought at a "30%-off" sale?

9. During one season the Lincoln baseball team played 48 games. The team won all but 6 of them. What per cent of the games did they win?

10. Mr. Smith bought an automobile for \$850. After he had used the car for a year, he sold it for 20% less than it cost him. How much did he receive for it?

DIAGNOSTIC TEST IN PER CENT

1. Express the following as per cents:

.25 .06 1.15 .2 1.4 .12$\frac{1}{2}$ .375

2. Express the following as hundredths:

28% 7% 3.5% 120% 146% 33$\frac{1}{3}$%

Express the following as per cents:

$\frac{1}{2}$ $\frac{1}{4}$ $\frac{2}{5}$ $\frac{1}{3}$ $\frac{7}{10}$ $\frac{9}{25}$ $1\frac{1}{8}$

4. Find:

6% of \$200	120% of \$48	3.6% of 200 lb.
20% of \$375	$33\frac{1}{3}$% of \$150	146% of 300 bu.

5. Find the missing numbers:

15 = —% of 20	35 = —% of 105	80 = —% of 1,000
75 = —% of 150	60 = —% of 50	35 = —% of 2,000

6. Express three-fourths as a fraction, a decimal, and as a per cent.

7. Find the interest on \$6.00 for 3 years at 6 per cent.

8. What part of a number is 100 per cent of that number?

9. Subtract 3.6% from 90%.

10. Add 7.8%, 6.4%, 7.3%, and 5.4%.

Practice on other examples similar to those with which you have special difficulty.

PROBLEM TESTS

Test I

1. Harry's father bought 10 gallons of gasoline at 24¢ a gallon, and 5 gallons of oil at 75¢ a gallon. How much did he pay for gasoline and oil?

2. An airplane traveled 172.5 miles in 1.5 hours. Find the speed an hour.

3. In the sixth grades of a large school, 52 per cent of the children were boys. Find the number of girls, if there were 100 sixth-grade children in all.

4. Find the interest on \$250 for 3 years at 6 per cent.

5. Find the volume of a rectangular tank, 6 feet long, 4 feet wide, and 2 feet deep.

Test II

1. Of a class of 40 children, 25 had perfect papers on an arithmetic test. What per cent did not have perfect papers?

2. A \$50-chair was on sale at a discount of 25 per cent. Find the sale price.

3. Find the length of a 10-acre piece of ground that is 120 rods wide.

4. On a map a line $\frac{1}{4}$ inch long represents 5 miles. What is the distance on this map between two places which are really 75 miles apart?

5. At a sale Mrs. Johnson bought $3\frac{3}{4}$ yards of cloth for \$2.25. If the regular price of the cloth was \$.90 a yard, how much less than the regular price was the sales price a yard?

Test III

1. Find the cost of excavating a basement 25 feet by 30 feet by 6 feet at \$1.25 a cubic yard.

2. Find the cost of linoleum for a floor 12 feet 8 inches by 7 feet 6 inches at \$2.10 a square yard.

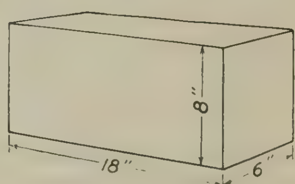
3. Find the cost of one ton of coal if $5\frac{3}{4}$ tons cost \$71.76.

4. A large can of peaches weighs 1 pound 4 ounces. Find the weight of 12 cans.

5. Harry weighed $95\frac{7}{8}$ pounds. The normal weight for a boy his age is 100 pounds. Find the per cent he was underweight.

6. Find the interest on \$125 for 6 months at 6%.

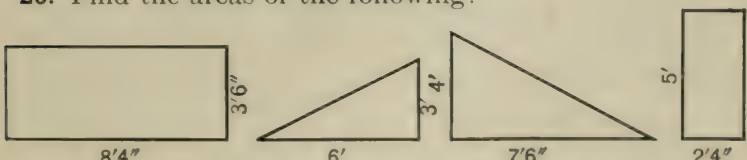
7. Find the volume of the figure at the right.



DIAGNOSTIC TEST VI

This exercise will test your ability to work different kinds of examples. If you have difficulty with any of the examples, practice on others like them.

1. $3\frac{3}{4} + 5\frac{5}{6} + 18\frac{7}{8} =$
2. Subtract $17\frac{1}{8}$ from $26\frac{1}{8}$.
3. Multiply: $3\frac{1}{3} \times 5 \times 8\frac{1}{4} =$
4. Divide $12\frac{1}{2}$ by $3\frac{1}{3}$.
5. Change $\frac{1}{8}$ to a decimal and to a per cent.
6. Change .15 to a common fraction.
7. Find the sum of 12.9, 9.98, 7.641, and 48.
8. Subtract 9.856 from 9.91.
9. Multiply 1.74 by .06.
10. Divide 71.28 by .648.
11. Express the following as per cents:
    .05 .2 1.2 $.12\frac{1}{2}$ 3.0 1.37 .16
12. Express the following as decimals:
    6% 15% 210% 50% 100% $16\frac{2}{3}$% $87\frac{1}{2}$%
13. Find 8% of \$125; 75 lb.; \$96.00.
14. 18 = —% of 50.
15. 3 = —% of 40.
16. 75 = —% of 60.
17. \$1.60 = —% of \$20.00.
18. Find the interest on \$300 for 6 months at 5%.
19. Subtract 6 bu. 12 qt. from 8 bu. 5 qt.
20. Find the areas of the following:



PROBLEM SCALE VI

Standards	
Excellent	9 or 10 correct
Good	7 or 8 correct
Fair	5 or 6 correct
Unsatisfactory	0 to 4 correct

1. Jack earned $1.20 for 6 hours of work in the neighbor's garden. What did he earn an hour?

2. Helen weighed $87\frac{1}{2}$ pounds. Her normal weight was 92 pounds. How much underweight was Helen?

3. Harry's father traveled 45 miles in 1.5 hours. How many miles did he travel an hour on the average?

4. Ten pounds of sugar cost 62 cents. What is the price a pound?

5. On a test of 20 words Mary spelled 75 per cent correctly. How many did she spell correctly?

6. On a test of 25 words Harry spelled 20 words correctly. What per cent did he spell correctly?

7. Mr. Smith's income last year was $4,250. He saved 21% of this. How much did he save?

8. Mr. Smith's prize Jersey cow yields about 4.5 pounds of butterfat a 100 pounds of milk. How much butterfat would 1,200 pounds of her milk yield?

9. On an arithmetic test containing 20 problems Helen had 90% correct. How many did she have incorrect?

10. Jack gave half of the $4\frac{1}{2}$ pounds of walnuts he had picked to Harry. Harry already had $1\frac{1}{2}$ pounds of pecans. How many pounds of nuts did Harry then have?

TABLES OF MEASURES

For Reference

Counting

12 things = 1 dozen
12 dozen = 1 gross
20 things = 1 score

Capacity

Liquid Measure

4 gills = 1 pint
2 pints = 1 quart
4 quarts = 1 gallon
231 cubic inches = 1 gallon

Dry Measure

2 pints = 1 quart
8 quarts = 1 peck
4 pecks = 1 bushel
2.150.42 cubic inches = 1 bushel

Weight

Avoirdupois Weight

16 ounces = 1 pound
100 pounds = 1 hundredweight (cwt.)
2,000 pounds or 20 hundredweight = 1 ton
2,240 pounds = 1 long ton

196 pounds = 1 barrel of flour
62.5 pounds = 1 cubic foot of water
*60 pounds = 1 bushel of wheat or potatoes
*56 pounds = 1 bushel of corn or rye

Troy Weight

For jewels and precious metals

24 grains = 1 pennyweight (pwt.)
20 pennyweights = 1 ounce
12 ounces = 1 pound
5,760 grains = 1 pound (Troy)
7,000 grains = 1 pound (Avoirdupois)

Length

12 inches = 1 foot
3 feet = 1 yard
$16\frac{1}{2}$ feet or $5\frac{1}{2}$ yards = 1 rod
5,280 feet, 1,760 yards, 320 rods = 1 mile

4 inches = 1 hand
6 feet = 1 fathom
1.151 common miles = 1 knot
3 knots = 1 league
360 degrees = 1 circumference

Surface or Square Measure

144 square inches = 1 square foot
9 square feet = 1 square yard
$30\frac{1}{4}$ square yards = 1 square rod
160 square rods or 43,560 square feet = 1 acre
640 acres = 1 square mile, or 1 section
36 sections = 1 township

* In most states.

Solid or Cubic Measure

1,728 cubic inches = 1 cubic foot
27 cubic feet = 1 cubic yard

Wood measure

16 cubic feet = 1 cord foot
128 cubic feet, or
8 cord feet = 1 cord
$24\frac{3}{4}$ cubic feet = 1 perch of stone

Time Measure

60 seconds = 1 minute
60 minutes = 1 hour
24 hours = 1 day
7 days = 1 week
365 days = 1 year
366 days = 1 leap year

Metric System (Equivalents)

10 millimeters = 1 centimeter
100 centimeters = 1 meter
100 meters = 1 kilometer

1 inch = 2.54 centimeters
1 foot = 30.48 centimeters
1 yard = 0.9144 meters
1 mile = 1.6093 kilometers

INDEX

(All problem units are indexed under problems)

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